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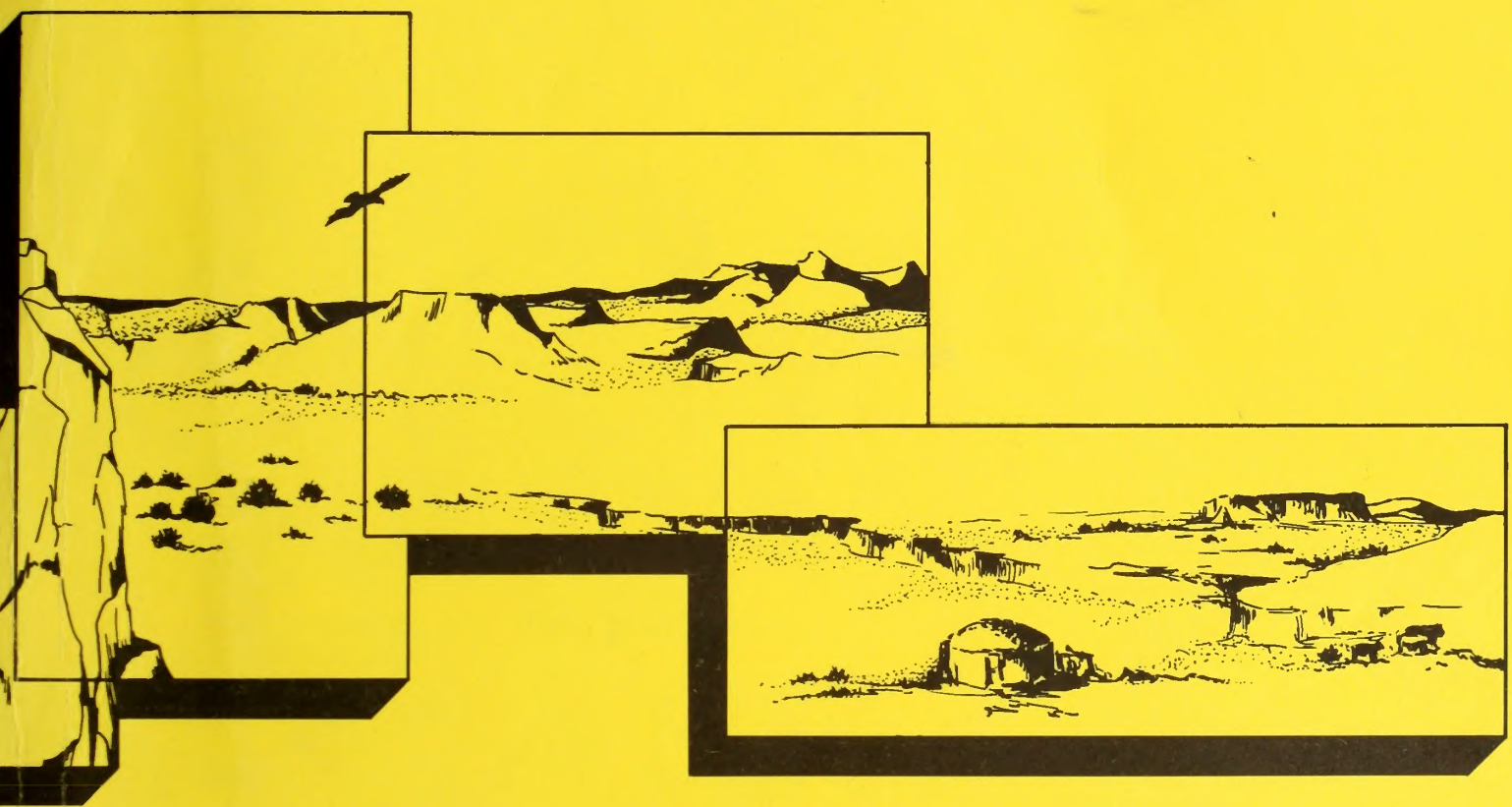
SAN JUAN RIVER REGIONAL COAL ENVIRONMENTAL IMPACT STATEMENT

NOVEMBER 1982



UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ALBUQUERQUE DISTRICT OFFICE
FARMINGTON RESOURCE AREA
FARMINGTON, NEW MEXICO

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

NOV 30 1982

Dear Sir or Madam:

This Draft San Juan River Regional Coal Environmental Impact Statement has been developed by the BLM Albuquerque District Office in accordance with the Council on Environmental Quality's regulations implementing the National Environmental Policy Act (40 CFR 1500-1508).

The public review period on this document will close at 4:30 p.m. on February 7, 1983. You are invited to comment on the adequacy of the draft, and may discuss it during the following informal open houses.

Farmington, December 14, 1982 from 3 to 9 p.m.
Civic Center
212 West Arrington
Exhibit Hall 1

Albuquerque, December 14, 1982, 3 to 9 p.m.
Convention Center
Isleta-Jemez Room
401 Second N.W.

Crownpoint, December 15, 1982, 3 to 9 p.m.
Navajo Chapter House

Gallup, December 16, 1982, 3 to 9 p.m.
Holiday Inn Meeting Room
Highway 66 West

Taos, December 16, 1982, 3 to 9 p.m.
Kachina Lodge
Cabaret Room
North Pueblo Road

Formal public hearings are scheduled for the following locations where you may make oral comments.

Crownpoint, January 10, 1983 starting 1 p.m.
Navajo Chapter House

Farmington, January 12, 1983 starting 9 a.m. and 7 p.m.
Civic Center
212 West Arrington
Exhibit Hall 1

Albuquerque, January 14, 1983 starting 9 a.m. and 7 p.m.
Four Seasons Motel
2500 Carlisle Blvd., N.E.

A specific time to testify should be reserved by contacting the BLM New Mexico State Office, P.O. Box 1449, Santa Fe, New Mexico 87501, (505) 988-6316.

Written comments are encouraged even if an oral presentation is made. A comment sheet is enclosed for this purpose. This sheet should be sent or submitted in person to:

State Director (912)
Bureau of Land Management
New Mexico State Office
P.O. Box 1449
Santa Fe, New Mexico 87501

Comments must be received by the close of business (4:30 p.m.) on February 7, 1983 in order to be considered in the preparation of the final environmental impact statement. Responses to oral and written comments addressing the adequacy of the statement will be included in the final document.

I look forward to receiving your comments, and thank you for your interest and participation.

Sincerely yours,

L. Paul Applegate

L. Paul Applegate
District Manager

Enclosures (2)
1-Comment Sheet
2-Draft EIS

SAN JUAN BASIN ACTION PLAN
COMMENT SHEET
SAN JUAN RIVER REGIONAL COAL EIS

Comments on this Draft EIS will be accepted through February 7, 1983 by:

State Director (912)
Bureau of Land Management
New Mexico State Office
P.O. Box 1449
Santa Fe, NM 87501

Please sign and date this sheet.

(Add continuation sheets as necessary.)

SAN JUAN RIVER REGIONAL COAL EIS

ERRATA

General Modifications

1. While the first regional sale has been scheduled for September, 1983, no decision has been made as to whether all the tracts selected by the Secretary would be sold at one time or in staggered sales. This should have no appreciable impact on the development timeframe used in this analysis.

2. Certain tracts (the Bypass Alternative tracts plus Gallo Wash #2 and Hospah #2) are expected to be combined with each other or with existing operations as a logical mining unit (LMU), rather than being developed separately. The "diligent development" requirements of 30 CFR 211 would thus be met in the combined or amended mine plan, even though actual operations on the portion analyzed in this EIS may not begin until many years later.

3. The Preference Right Lease Applications are included in the No-Action Alternative, rather than a leasing alternative, because of the PRLA processing requirements and the lack of Secretarial discretion to issue a lease for a PRLA that meets final showing requirements.

Specific Modifications

Page ix, Paragraph 4, Sentence 1: Should read, "New Mexico's 24-hour air quality standard for total suspended particulates would be slightly exceeded."

Page ix, Paragraph 7, Sentence 1; Page x, Paragraph 3, Sentence 2; and Page x, Paragraph 5, Sentence 2: Should read, "The New Mexico 24-hour air quality standard for total suspended particulates would be significantly exceeded."

Page 1-33, Paragraph 1, Sentence 2: Should read, "However, by adding the additional tracts of the Bypass Alternative, cumulative impacts would cause the state's 24-hour ambient air quality standards to be slightly exceeded."

Page 2-38, Table 2-12, Line 5: Should read, "NM 44/Jct. 25 (E. of Bernalillo)-Jct. 550/288/1.3."

Page 3-5, Paragraphs 3 through 7 should read:

> The development of the PRLAs is estimated to result in the emission of 3,542 tons of total suspended particulates (TSP) per year. The resulting 24-hour ground level concentration of 100 ug/m^3 is shown in Table 3-1. The concentration does not exceed any of the New Mexico or National Ambient Air Quality Standards (NAAQS).
>
> The frequency of occurrence of the 24-hour maximum values could not be determined with this analysis. More realistic 24-hour impacts could be obtained using a short-term model and appropriate 24-hour meteorological data when more detailed mine site information is developed at the mine-plan stage. As seen in Appendix G, the TSP concentrations are limited in spatial extent (beyond the coal lease boundaries), as would be expected of larger particles resulting from

mining activities. The annual average concentration values are generally more appropriate for determining regional impacts. The 24-hour maximum was estimated from the annual values by the Larsen transformation method. Although the 24-hour value is considered a conservative value, it should be viewed with caution.

A Class II area, the Chaco Culture National Historical Park, was examined to determine if the TSP levels allowable under the PSD regulations would be exceeded. The increased TSP levels would be below the applicable Class II increments. The two Class I areas in closest proximity to the mine lease tracts (Mesa Verde National Park and the San Pedro Parks Wilderness) were also examined. The calculated TSP levels were significantly below the allowable Class I increments.

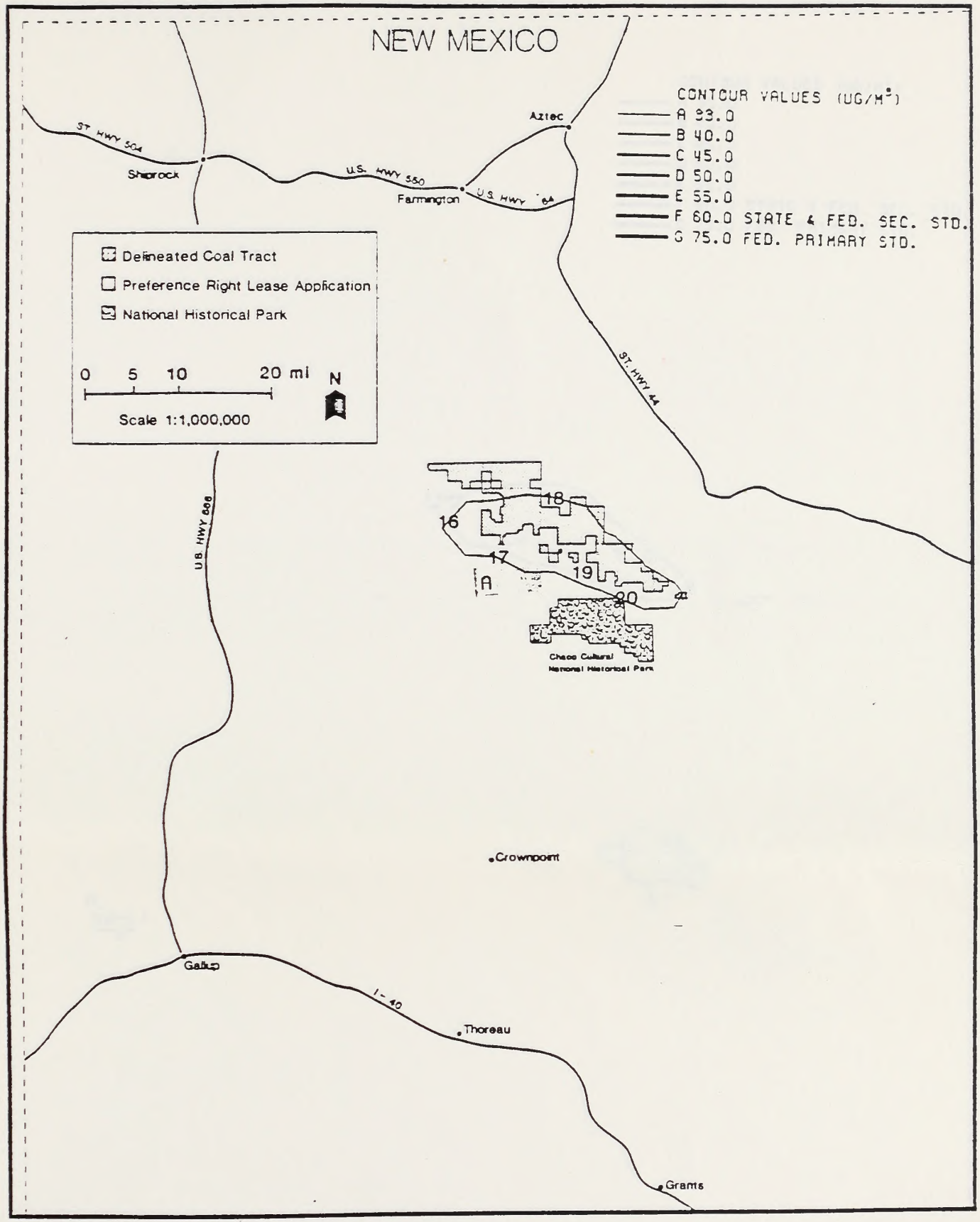
Fugitive dust particles suspended in air can cause a reduction in visual range as a result of the scattering of light. An approximate assessment of reduction in visual range from this alternative was made using the approach of Ursenbach (1978). Assuming an annual background concentration of 30 ug/m^3, the visual range would be reduced from 73 to 67 miles (by 8 percent). Short-term (24-hour) concentrations would result in a reduction of visual range to 32 miles, a decrease of 56 percent.

Using the 73 miles of visibility calculated above for the Chaco Culture National Historical Park, visual range reductions would be 3 percent on an annual basis and 18 percent on a short-term, 24-hour basis. However, actual visual range measurements made at the park by the National Park Service indicate an average visual range of approximately 127 miles. Based on the 127 miles of visibility and using Ursenbach's equation, the calculated reductions in visibility would be 7 and 23 percent on an annual and short-term basis, respectively.

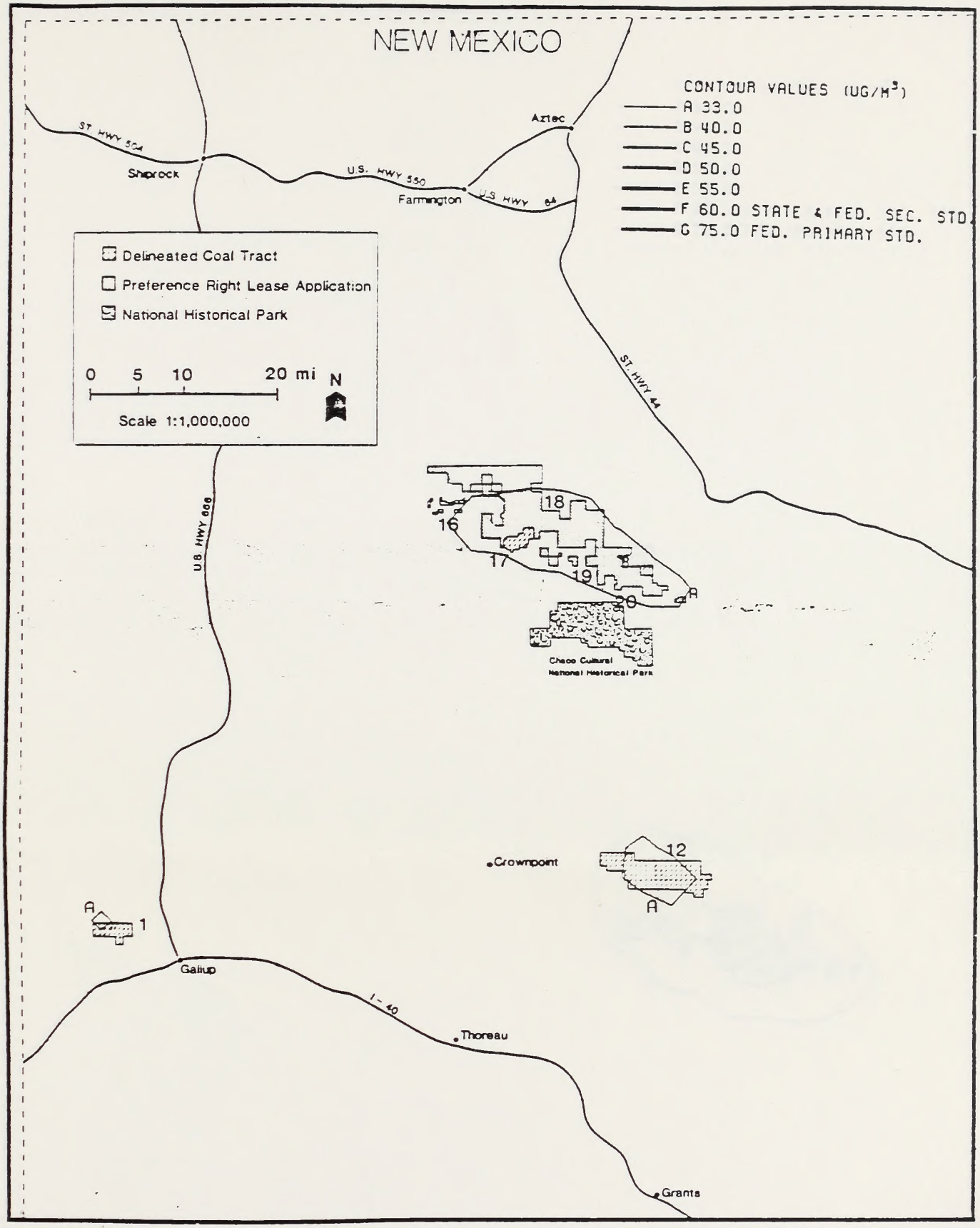
Page 3-6, Table 3-1: The title of the table should be, "TOTAL SUSPENDED PARTICULATES (TSP) EXCEEDED BY ALTERNATIVE." The title of the third column should be "TSP Exceeded."

Page 3-7, Paragraph 1: The following sentence should be added as Sentence 2, "According to the New Mexico Environmental Improvement Division, the PSD baseline has not been triggered."

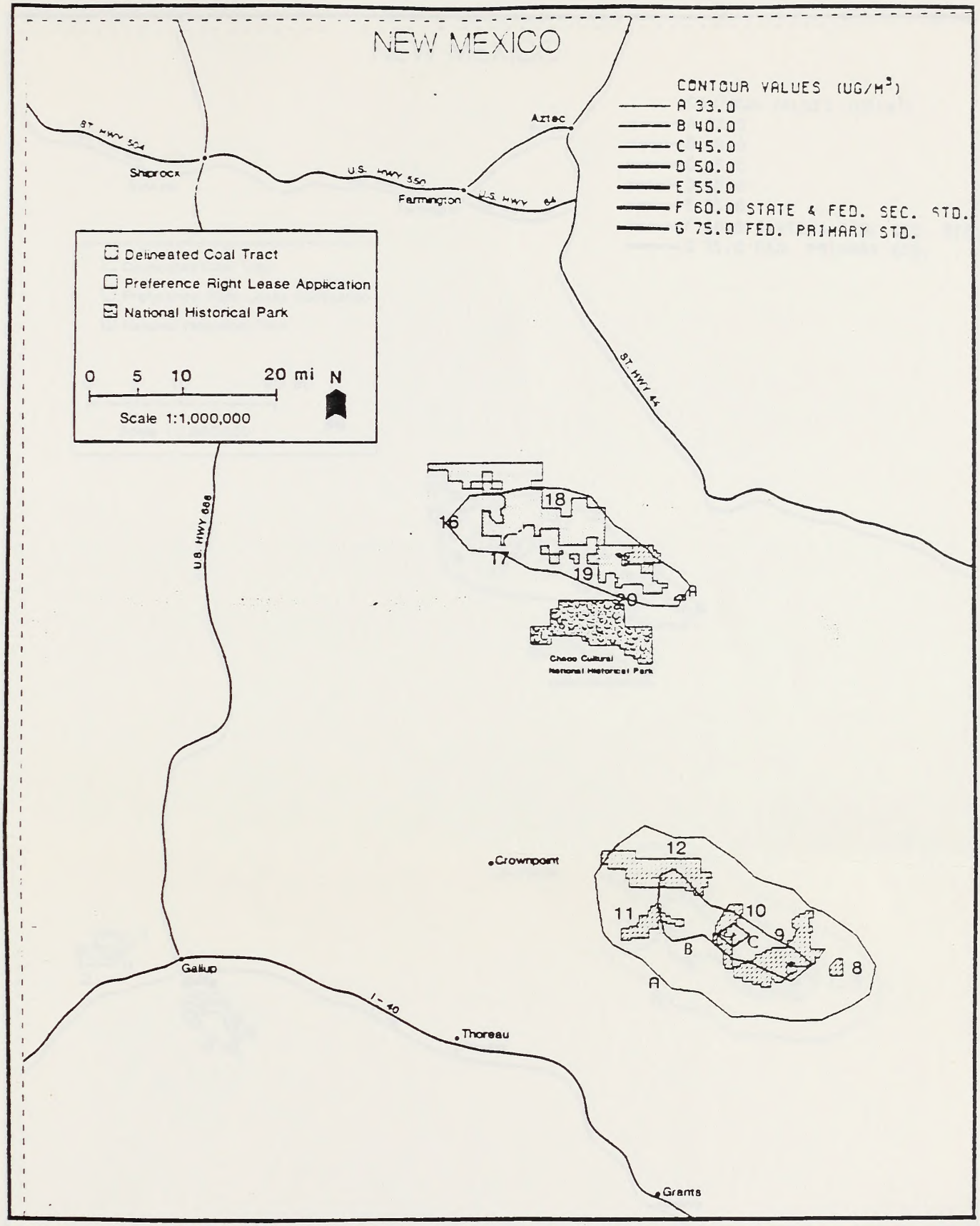
Appendix G: Should include the attached maps.



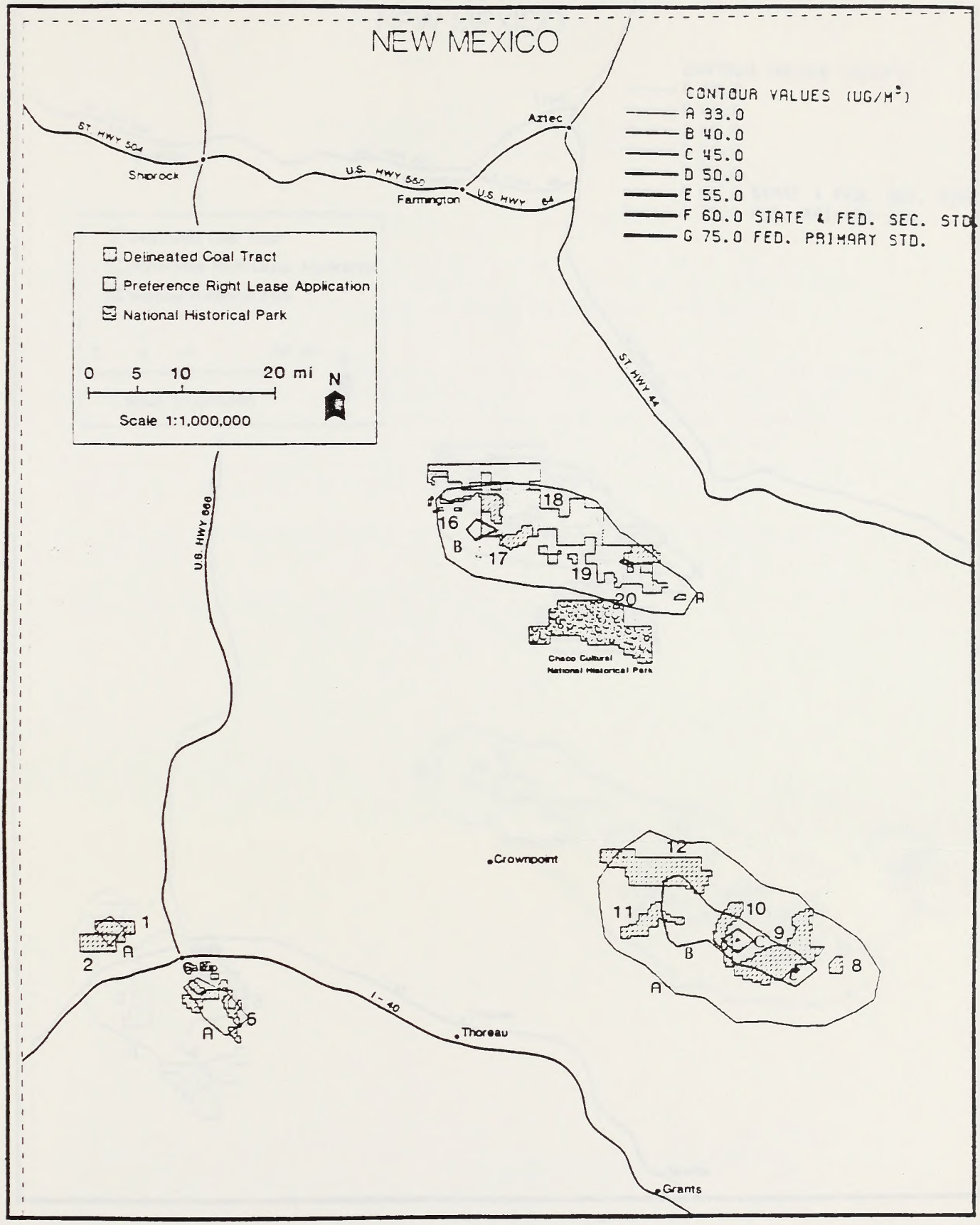
MAP G-1 ANNUAL AVERAGE AMBIENT TSP CONCENTRATION, NO ACTION ALTERNATIVE



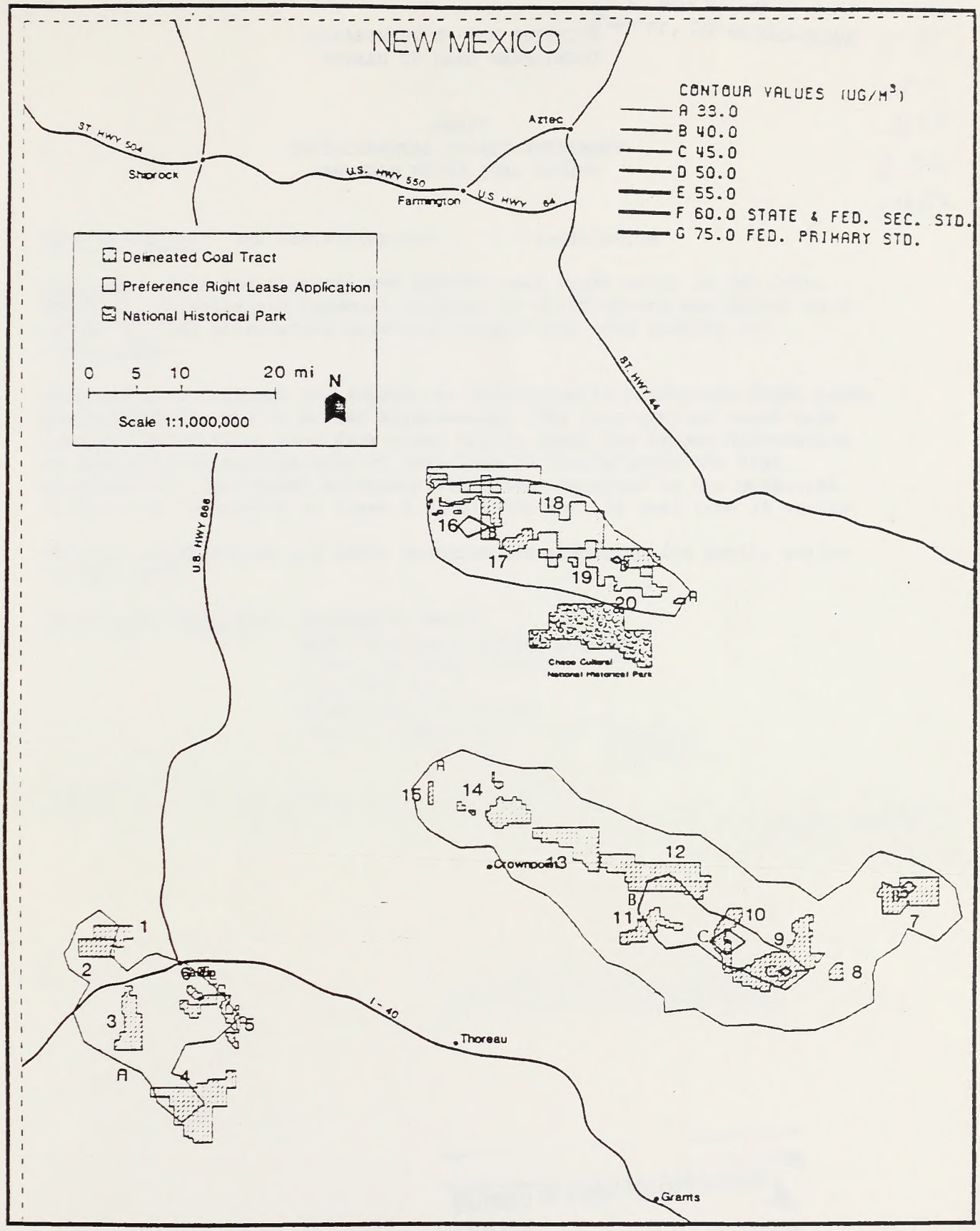
MAP G-2 ANNUAL AVERAGE AMBIENT TSP CONCENTRATION, BYPASS ALTERNATIVE



MAP G-3 ANNUAL AVERAGE AMBIENT TSP CONCENTRATION, MINIMUM SURFACE OWNER CONFLICT ALTERNATIVE



MAP G-4 ANNUAL AVERAGE AMBIENT TSP CONCENTRATION, TARGET ALTERNATIVE



MAP G-5 ANNUAL AVERAGE AMBIENT TSP CONCENTRATION, HIGH ALTERNATIVE

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DEPARTMENT OF THE INTERIOR
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DRAFT
ENVIRONMENTAL IMPACT STATEMENT
SAN JUAN RIVER COAL REGION

Type of Action: (x) Administrative ( ) Legislative

Abstract: This EIS analyses the impacts that would occur in San Juan, McKinley, Valencia and Sandoval counties in Northwestern New Mexico as a result of four alternative levels of competitive coal leasing and development.

This EIS also includes the impacts of developing 26 Preference Right Lease Applications in the No Action Alternative. The alternatives range from leasing .129 billion tons from eight tracts under the Bypass Alternative to leasing 1.94 billion tons of coal from 39 tracts under the High Alternative. The Target Alternative has been selected as the preferred alternative, proposing to lease 1.32 billion tons of coal from 24 tracts.

The four alternatives and their analyses are presented for public review in this DEIS.

Contact for this EIS: Richard T. Watts
BLM, Farmington Resource Area
900 N. La Plata Highway
P.O. Box 568
Farmington, NM 87499
Phone: Commercial: (505) 325-3581
FTS: 572-6220

Comments have been requested from: See Chapter 4.

Date Filed with EPA - Draft: NOV 30 1982
Final:

State Director, BLM New Mexico

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SAN JUAN RIVER REGIONAL COAL EIS

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SUMMARY

SUMMARY

This Draft Environmental Impact Statement (DEIS) discusses the environmental, social, and economic impacts of the proposed mining of 39 new competitive coal tracts in northwest New Mexico. These tracts would be leased by the Bureau of Land Management (BLM) to meet the leasing target of 1.2 to 1.5 billion tons of in-place federal coal as established by the Secretary of the Interior. The DEIS also discusses the impacts of mining 26 existing Preference Right Lease Applications (PRLAs) within the No Action Alternative.

A Site-Specific Analysis (SSA) was prepared by the BLM for each tract and served as the basis for tract ranking and alternative formulation by the RCT. These SSAs are summarized in Appendix A-1 of this EIS.

The Regional Coal Team (RCT) formulated five alternatives for environmental analysis. Four are leasing alternatives (Bypass, Minimum Surface Owner Conflicts, Target and High), and the fifth is the No Action Alternative (which involves no competitive leasing of federal coal). The RCT has selected the Target Alternative (which includes the mining level of the No Action Alternative) as the Preferred Alternative that would best meet the nation's need for coal.

These alternatives are analyzed with emphasis on the significant primary and secondary impacts. The discussion of the impacts is commensurate with the significance of the issues.

NO ACTION ALTERNATIVE

This alternative covers the development of existing leases as well as the issuance of new leases for 2.2 billion tons of federal coal on 26 existing PRLAs. Alteration of topography would occur as a result of surface and subsurface mining. Numerous fossil collection sites would be destroyed, but subsurface fossil information would become available during mining. Soil mixing, contamination, compaction and short-term acceleration of erosion would occur.

Vegetation would be removed and AUMs lost during active mining and before reclamation is complete. However, strict reclamation regulations enforced by the Office of Surface Mining and the State of New Mexico Energy and Mineral Division would be adhered to. An increase in the demand for water resources and some decrease in water quality could occur. Four ferruginous hawks, a prairie falcon and their nests could be disturbed. Other wildlife habitats would also be affected.

Numerous cultural resource sites have been found in the EIS Region and many more are projected to occur. Many of these sites are very significant. Sacred sites and gravesites important to the Navajo people would be disturbed or destroyed, although measures would be taken to minimize adverse effects.

Dispersed recreation opportunities are ample throughout the region, but the quality of these experiences may be diminished because of the increased population expected under this alternative. Some mining would occur near Wilderness Study Areas (WSAs) and along highways. Visual quality would be diminished for travelers along these highways, and for visitors, the wilderness experience would be diminished within the WSAs.

Significant population changes in some communities could cause an inflationary economy and the need for expansion of community infrastructures. Increased revenue base from coal development would defray the costs incurred for community expansion. Increased vandalism, crime and other social problems would occur, as would greater demand on existing transportation facilities. Impacts to the social structure and lifestyle of 55 Navajo families living on the lands assessed under this alternative would be substantial.

BYPASS ALTERNATIVE

This alternative would allow the competitive leasing of 129 million tons of federal coal from eight tracts. Mining of these tracts would be in conjunction with mining on adjacent existing leases and PRLAs. Leasing coal from these tracts would not increase annual production, or numbers of workers, and would have little economic or social impacts other than to lengthen the period of mining by a few years. The cumulative impacts resulting from this alternative are in addition to those described for the No Action Alternative.

New Mexico's 24-hour air quality standard for total suspended particulates would be slightly violated. Some fossil localities would be disturbed, as would up to 200 acres of deer and elk winter range. One ferruginous hawks and their nesting sites could be disrupted by mining on the tracts under this alternative. The lifestyle of four Navajo families would be substantially disrupted.

MINIMUM SURFACE OWNER CONFLICTS ALTERNATIVE

This alternative consists of tracts that require no surface owner consent or for which consent has been given. Under this alternative, 916 million tons of federal coal from 11 tracts would be competitively leased.

The cumulative impacts of this alternative would be in addition to those described for the No Action Alternative. Generally, these cumulative impacts would be considerably less than those of the Target and High Alternatives.

New Mexico's 24-hour air quality standard for total suspended particulates would be significantly violated. Impacts to sensitive fossil localities would be less than under the Bypass Alternative, and no impact would occur to wildlife species of high federal interest. The lifestyle of 24 Navajo families living on lands included under this alternative would be substantially disrupted.

The Lee Ranch and the Divide Tracts are close to the planned Star Lake Railroad, providing an economic advantage over mines located further north on the proposed railroad. This alternative would also disperse the socioeconomic impacts by providing a high proportion of development away from Farmington compared to the other alternatives.

TARGET ALTERNATIVE

This alternative would allow the competitive leasing of 1.32 billion tons of federal coal from 24 tracts. The cumulative impacts of this alternative would be in addition to those impacts described for the No Action Alternative.

Overall, destruction or disturbance of resources under this alternative would be much greater than that under the Bypass or Minimum Surface Owner Conflicts Alternative. The New Mexico 24 hour air quality standard for total suspended particulates would be significantly violated. One golden eagle and one ferruginous hawk and nesting site could be disrupted by mining. The lifestyle of 70 Navajo families living on lands included under this alternative would be substantially disrupted.

HIGH ALTERNATIVE

Under this alternative, 1.94 billion tons of federal coal would be competitively leased from 39 tracts. The cumulative impacts resulting from this alternative would be in addition to those described for the No Action Alternative.

The impacts associated with the leasing level of this alternative would be nearly double those of the Target Alternative. New Mexico's 24-hour air quality standard for total suspended particulates would be significantly violated. One golden eagle and one ferruginous hawk and their nesting sites could be disrupted. The lifestyle of 455 Navajo families living on land included under this alternative would be substantially disrupted.

A more detailed summary of the impacts of each alternative can be found in Chapter 1, Chapter 3 ("Comparison of the Impacts of the Alternatives" section) and Table 1-8.

CHAPTER 1

DESCRIPTION OF THE ALTENNATIVES

CHAPTER 1

DESCRIPTION OF THE ALTERNATIVES

INTRODUCTION

In June of 1980, the Secretary of the Interior adopted a new program for the management of coal resources on federal lands. Information from the Department of Energy as well as the coal mining and consuming industries was used to estimate the demand for new federal coal leasing. Land use plans, industry data, environmental analyses, and the concerns of the public and federal, state and local officials are now being used to identify specific coal lease tracts to supply that demand.

The nation's coal reserves have been divided into twelve regions scattered throughout the continental United States. This Environmental Impact Statement (EIS) addresses the environmental consequences of four leasing alternatives in the Bureau of Land Management's (BLM's) San Juan River Coal Region, which encompasses northwest New Mexico and southwest Colorado (refer to Map 1-1, next page, and Visual A, which can be found in the map pocket at the end of the EIS). This EIS will be used with other relevant material by the Department of the Interior (DOI) to plan actions and make decisions with respect to federal coal leasing in the region.

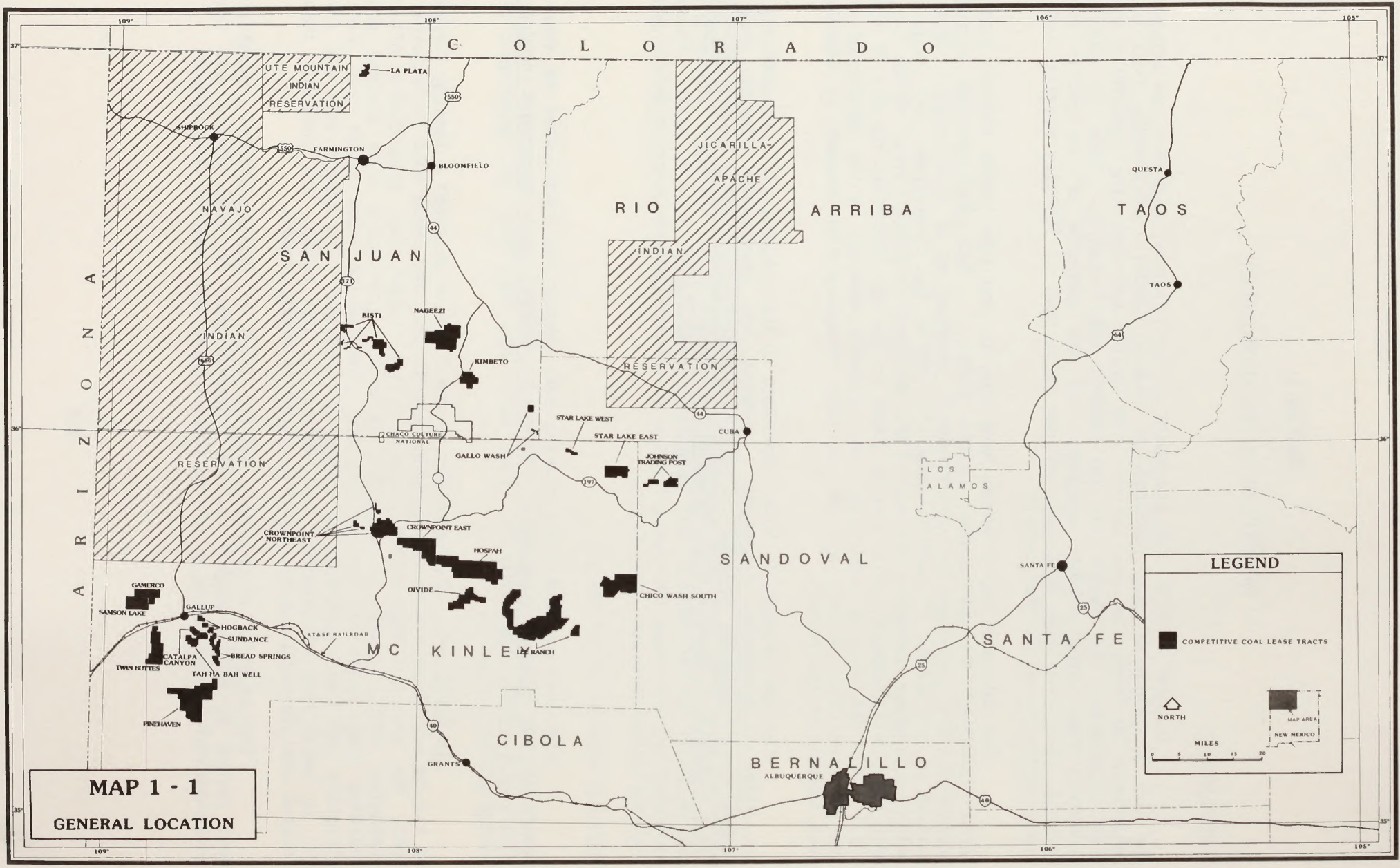
The coal program is fully described in the following DOI publications: the Final Environmental Statement: Federal Coal Management Program 1979; Federal Coal Management Program - A Narrative Description (1979); in Secretarial Issue Document - Federal Coal Management Program (1979). Further information can be found in the federal coal management regulations (43 CFR 3400). These documents are available for public review at the Albuquerque District Office and the Farmington Resource Area Office.

NEED FOR LEASING IN THE REGION

The need for additional federal coal leasing was established and documented in the Final Environmental Statement: Federal Coal Management Program (USDI, BLM 1979), the analysis that went into that EIS, and Department of Energy production goals.

In April 1982, the Secretary of the Interior selected a leasing target of 1.2 to 1.5 billion tons of in-place federal coal for lease sale in September 1983, for the San Juan River Region. This target was established after extensive public hearings, analyzing potential production from planned and existing coal mines in the region, and consultation with state and local officials and the Departments of Energy and Justice. The target will aid the DOI in satisfying anticipated coal demand in the region and ensuring that federal coal is available to meet the country's energy needs.

The level of actual need and the level of leasing within a specific coal region is still subject to the uncertainties of coal demand and the environmental acceptability of mining technologies and level of development.



MAP 1 - 1

GENERAL LOCATION

The actual level of development will be determined through federal and state review of individual mining plans and plant siting applications. Ultimately, the economic market and demand for coal will determine which tracts will be developed.

The alternatives presented in this EIS are analyzed to identify the type and extent of the impacts of competitively leasing various levels of federal coal and to compare these impacts to those of the No Action Alternative, which involves no new federal coal leasing.

PROGRAM IMPLEMENTATION TO DATE

Following completion of the Chaco/San Juan transition MFP for coal, which considered input from the state, industry, and public sectors, the BLM issued a call for expressions of leasing interest from the public. In addition, persons or groups owning the surface over federal coal reserves were offered the opportunity to refuse to allow mining of these coal reserves in exercise of their right under the Surface Mining Control and Reclamation Act of 1977 (SMCRA).

A Regional Coal Team (RCT) was formed in October 1980 with BLM and state officials to oversee the leasing process and make recommendations to the Secretary of the Interior regarding leasing actions and regional leasing targets. A series of meetings open to the public was held by the RCT to consider: surface owner refusals to allow mining, industry interest in leasing and development, energy needs for the region, and the type of geologic and mining information to be used by the Minerals Management Service (MMS) to delineate specific tracts for potential leasing.

The MMS then prepared tract summary reports that the BLM used to prepare a site-specific analysis (SSA) for each of the 50 tracts that MMS delineated. (Refer to Appendix A-1 for a summaries of the SSAs). The RCT analyzed these SSAs and ranked the tracts based on coal economics, and environmental, and social, and economic impacts. From this analysis the RCT formulated four leasing alternatives along with the No Action Alternative, consisting of varying levels of production and combinations of tracts to be assessed in this EIS.

The Secretary of the Interior's decision on course of action is not limited solely to the alternatives presented in this EIS. He may select additional alternatives that are intermediate in magnitude to those analyzed. These intermediate alternatives could be developed through changes in the proposed level of leasing, different tract combinations, alteration of tract boundaries, changes in the lease sale schedule, or modification of the leasing target. These alternatives could be developed in response to expressed preferences of the Governor of New Mexico, the analysis in the EIS, recommendations of the RCT, public input, and coordination with other federal agencies.

The 26 Preference Right Lease Applications (PRLAs) addressed in the Environmental Assessment for Coal Preference Right Leasing, New Mexico (USDI, BLM 1981) are addressed in this EIS as part of the No Action Alternative.

Further information on the implementation of the federal coal program in the region and the history and background leading to the publication of this EIS is found in Appendices A-2 and A-3.

DESCRIPTION OF THE ALTERNATIVES

No Action Alternative

This alternative proposes no new competitive leasing of federal coal. Coal production would result from (1) the development of coal from existing and proposed coal mines under contract commitments or mine plans; and (2) the issuance of federal leases for 26 existing Preference Right Lease Applications (PRLAs) (refer to Table 1-1). The PRLAs are shown on Visual C. All but two of the seven PRLA units would be surface mined.

In-place reserves for leased federal coal are approximately 2.2 billion tons, with 1.75 billion tons being recoverable. Projected coal production in 1987 and the year 2000 would be approximately 41 and 47 million tons, respectively (refer to Figure 1-1). Of this amount, 1.6 million tons would be mined in 1987 and 20.5 million tons would be mined in the year 2000 from PRLA mining units.

Approximately 31,970 total acres would be disturbed under this Alternative. Before reclamation, surface mining would disturb approximately 1,500 acres in 1987 and 10,000 acres in the year 2000 on the PRLAs. Approximately 705 acres would be disturbed on PRLA mining units by onsite surface facilities, including coal and topsoil storage acres, haul, and access roads, and power and telephone lines. About 12,850 acre-feet of water per year would be required for use in mining seven PRLA mining units. For additional information regarding the PRLAs, refer to the Final Environmental Assessment for Coal Preference Right Leasing, New Mexico (USDI, BLM, 1981b).

Bypass Alternative

This alternative proposes to lease eight competitive tracts in September 1983, all of which would be surfaced mined (refer to Table 1-2). These eight tracts are located next to existing and proposed mines and PRLAs (refer to Table 1-3), and it is assumed that the tracts would not be mined (would be bypassed) unless adjacent mining operations extend into them. If the tracts were mined, the construction, mining and coal transportation personnel would be the same personnel working on operating mines adjacent to the tracts. Construction would begin between 1984 and the year 2009, with production starting during the second year of construction. Surface mines would require 4 years for construction.

Federal in-place reserves that would be leased total approximately 129 million tons, of which 113 million tons would be recoverable. Projected coal production would be approximately 1.63 million tons from four tracts in 1987 (start-up) and 3.75 million tons from four tracts for the year 2000 (peak production). (Refer to Figure 1-1). Projected average annual coal production would be approximately 2.26 million tons from 1985 through the year 2007 for

TABLE 1-1
PRELIMINARY ESTIMATES OF DEVELOPMENT DATES FOR THE
PRLAs IN THE SAN JUAN RIVER REGION
(NO ACTION ALTERNATIVE)

Company	PRLA No.	Type of Mine	Initial Construction	Initial Production	Abandonment
Eastern Assoc.	NM 3836 [1] NM 3835 NM 6802 NM 7235	Surface	1989	1990	Year 2025
Eastern Assoc. & Kinark-North	NM 6801 NM 3834 NM 3838 NM 11916	Underground	1989	1990	Year 2025
Eastern Assoc. - South	NM 6803 NM 3836 [1] NM 3837 NM 6804	Underground	1989	1990	Year 2025
Arkland #1	NM 3752 NM 3753 NM 3754 NM 3755 [2]	Surface	1986	1987	Year 2022
Arkland #2	NM 3755 [2] NM 3919 NM 3918 NM 8745	Surface	1988	1989	Year 2024
Thermal Energy Company	NM 9764 NM 8128 NM 8129 NM 8130 NM 8715 NM 8717 NM 11670	Surface	1986	1987	Year 2022
Freeman United	NM 585	Surface	1986	1987	Year 2022

Note: [1]This PRLA covers both a surface and an underground mine.
[2]This PRLA is split into two mining units.

FIGURE 1-1

COAL PRODUCTION BY ALTERNATIVE FOR 1987, 1990, 1995, AND 2000

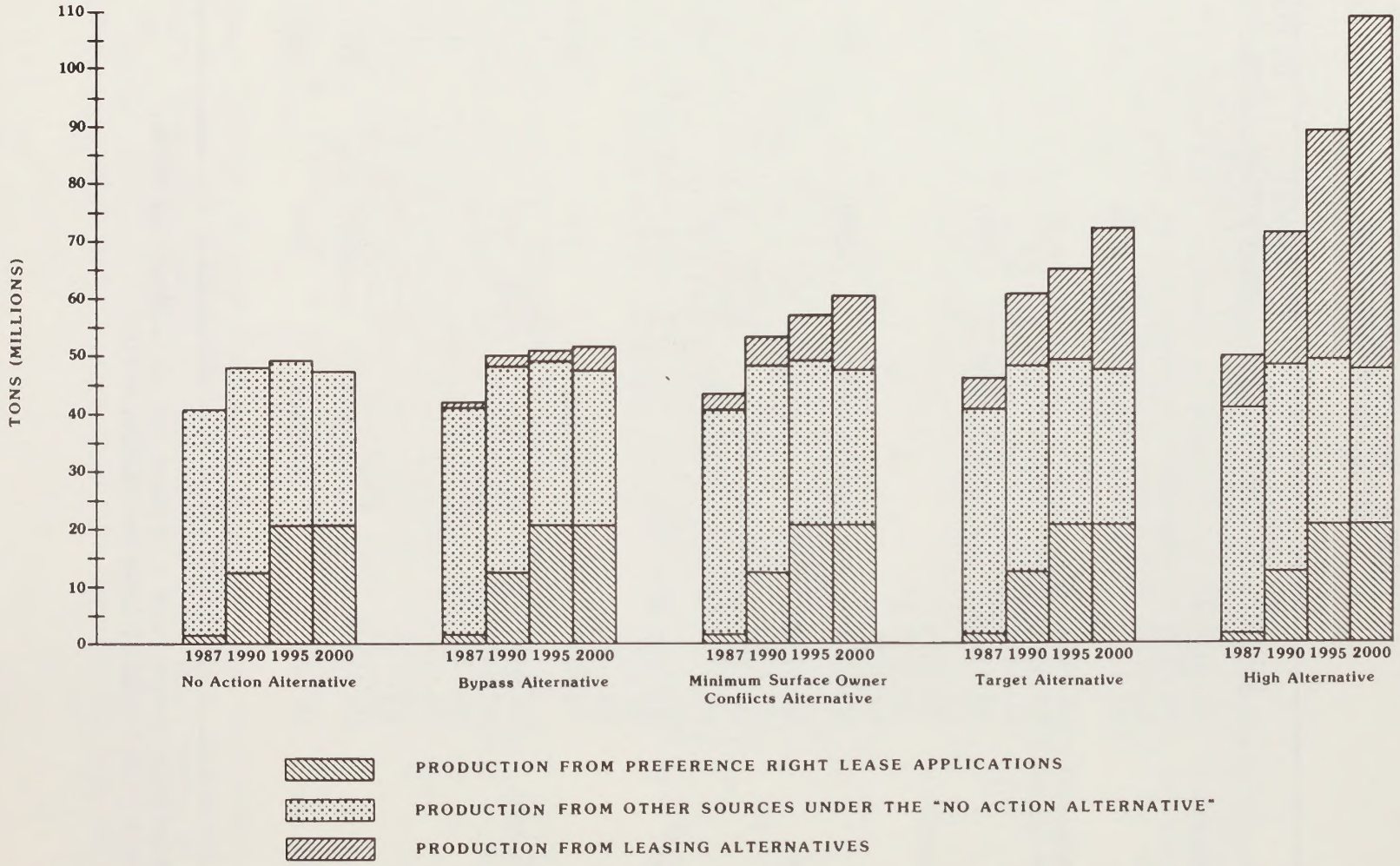


TABLE 1-2

COMPETITIVE COAL LEASE TRACTS BY ALTERNATIVE

Bypass Alternative	Minimum Surface Owner Conflicts Alternative	Target Alternative	High Level Alternative	
La Plata #1	La Plata #1	La Plata #1	La Plata #1	Bisti #2
Star Lake West #2	La Plata #2	La Plata #2	La Plata #2	Catalpa Canyon
Kimbeto #2	Kimbeto #1	Star Lake West #2	Star Lake West #2	Sundance Samson Lake
Gallo Wash #1	Kimbeto #2	Kimbeto #1	Kimbeto #1	#2/2
Bisti #6/8	Nageezi	Kimbeto #2	Kimbeto #2	La Plata #3
Hospah #1	Gallo Wash #2	Nageezi	Nageezi	La Plata #4
Gamerco #1 (HC)	Lee Ranch East	Gallo Wash #1	Gallo Wash #1	Star Lake East (LC)
Bisti #4	Lee Ranch Middle Lee Ranch West	Gallo Wash #2	Gallo Wash #2	Crownpoint Northeast
	Divide	Bisti #6/8	Bisti #6/8	Crownpoint East (HC/LC)
	Hospah #2	Lee Ranch East	Lee Ranch East	Chico Wash South
		Lee Ranch Middle	Lee Ranch Middle	Ta-ha-bah Well
		Lee Ranch West	Lee Ranch West	Hogback
		Divide	Divide	Twin Buttes
		Hospah #1	Hospah #1	Pinehaven
		Hospah #2	Hospah #2 Gamerco #1	Bread Springs #1
		Gamerco #1 (HC)	(HC) Bisti #4	Bread Springs #2
		Bisti #4	Johnson Trading Post	Gamerco #1 (LC)
		Johnson Trading Post	Star Lake East #1	Gamerco #2 (LC)
		Star Lake East #1	Bisti #1	Samson Lake #1
		Bisti #1		
		Bisti #2		
		Catalpa Canyon		
		Sundance		
		Samson Lake #2/2		

TABLE 1-3

COMPETITIVE COAL LEASE TRACTS LOCATED ADJACENT
TO EXISTING AND PROPOSED MINES, LEASES, & PRLAS
(BYPASS ALTERNATIVE)

Tract	Existing Lease/Mine	Proposed Lease/Mine	PRLA
La Plata #1	Black Diamond Mine		
Star Lake West #2		Star Lake Mine	NM 8715
Kimbeto #2			NM 3918 NM 3919
Gallo Wash #1			NM 8128
Bisti #6 a/	NM 186612		
Bisti #8 a/	NM 186612 NM 186615 De-na-zin Mine		
Hospah #1		South Hospah Mine	
Gamerco #1 (HC)	Mentmore Mine		
Bisti #4			NM 3754

Note: a/ Bisti #6 and #8 are one tract. They have been separated to show which leases and mine they are located next to.

seven of the eight tracts. The Hospah #1 Tract is projected to begin production in the year 2010.

The total amount of surface disturbed on these tracts would be approximately 6,130 acres. Before reclamation, surface mining would disturb approximately 373 acres on four tracts in 1987 and approximately 1,342 acres on four tracts in the year 2000 (refer to Table 1-4). Approximately 600 acres would be disturbed for onsite surface facilities, including coal and topsoil storage areas, haul and access roads, and power and telephone lines.

TABLE 1-4
SURFACE ACRES DISTURBED
BY EACH ALTERNATIVE

Alternative	Mining 1987	Mining Year 2000	Surface Facilities	Acres/ Year	Acres/ Mine Life
No Action	10,800	19,300	705		31,970
Bypass	364	1,342	600	395	6,130
Minimum Surface Owner Conflicts	308	4,988	1,050	510	19,302
Target	859	10,593	2,100	1,177	35,977
High	1,771	23,641	3,500	2,120	68,641

Minimum Surface Owner Conflicts Alternative

This alternative proposes to lease 11 tracts in September, 1983. Six of the tracts listed in Table 1-2 would be surface mined, and five would be underground mined.

It appears that minimal conflicts with surface owners regarding coal mining would occur on these tracts. Federal in-place reserves that would be leased are approximately 916 million tons, of which 349 million tons are recoverable. Projected coal production would be approximately 2.1 million tons in 1987 (start-up) from three tracts and 13.4 million tons for the year 2000 (peak production) from seven tracts (refer to Figure 1-1). Projected average annual coal production would be approximately 7.15 million tons from 1985 through the year 2007 for 9 of the 11 tracts. The Gallo Wash #2 and Hospah #2 tracts are projected to begin production in the year 2015 and 2020 respectively.

The total amount of land disturbed on these tracts would be approximately 19,302 acres. Acres disturbed per year are listed in Table 1-4. Before reclamation, surface mining would disturb approximately 308 acres on two tracts in 1987 and approximately 4,988 acres on five tracts in the year 2000. Approximately 1,050 acres of these tracts would be disturbed by onsite surface facilities composed of coal and topsoil storage areas, haul and access roads, and power and telephone lines.

Construction would begin between 1984 and the year 2019, with production starting during the second year of construction. Surface and underground mines would require 4 and 6 years respectively for construction.

Approximately 1,071 construction workers would be required to bring the 11 mines into production. As the mines came into produciton in the second year, a number of construction workers would be replaced by production and transportation workers.

Target Alternative

This is the preferred alternative. The tracts in this alternative are those included in the Bypass and the Minimum Surface Owner Conflicts Alternatives, with additional tracts being added by the RCT to achieve a production level that would fall within the Secretary of the Interior's target range of 1.2 to 1.5 million tons of coal. This preferred alternative is that of the RCT, not necessarily that of the Secretary, nor does it bind the Secretary in any way in reaching a final federal leasing decision.

This alternative proposes to lease 24 tracts in September 1983 (refer to Table 1-2). Nineteen tracts would be surface mined and five would be underground mined. Federal in-place reserves that would be leased are approximately 1.32 billion tons, with approximately .7 billion tons being recoverable. Projected coal production would be approximately .005 billion tons in 1987 (start-up) on 12 tracts and .025 billion tons in the year 2000 (peak production) on 16 tracts (refer to Figure 1-1). Projected average annual coal production would be approximately .13 billion tons from 1985 through the year 2007 for 21 of the 24 tracts.

The Hospah #1, Gallo Wash #2, and Hospah #2 tracts are projected to begin production in the year 2010, 2015, and 2020 respectively. These three tracts have been analyzed in this EIS as if they had met the ten-year diligent development requirement. However, due to their location and the fact that Hospah #2 and Gallo Wash would be underground mines, industry does not expect to mine these tracts until the years indicated.

The total amount of disturbance on these 24 tracts would be approximately 35,977 acres. Acres disturbed per year are listed in Table 1-4.) Before reclamation, surface mining would disturb approximately 859 acres on 11 tracts in 1987 and 10,593 acres on 14 tracts in the year 2000. Approximately 2,100 acres of these tracts would be disturbed by onsite surface facilities, including coal and topsoil storage areas, haul and access roads, and power and telephone lines.

Construction would begin between 1984 and the year 2019. Surface and underground mines would require 4 and 6 years respectively for construction, and production would start during the second year of construction.

Approximately 2,152 construction workers would be required to bring the 24 mines into production. As the mines came into production in the second year, a number of construction workers would be replaced by production and transportation workers.

High Level Alternative

This alternative proposes to lease all 39 tracts brought forward in the tract selection process in September of 1983. Of this total, 28 tracts would be surface mined and 11 would be underground mined. All 39 competitive coal lease tracts are shown on Visual C (found in the map pocket on the back cover) and listed in Table 1-2.

Federal in-place reserves that would be leased total approximately 1.94 billion tons, of which approximately 1.09 billion tons are recoverable. Projected coal production would be approximately .009 billion tons in 1987 (start-up) for 19 tracts and .062 billion tons in the year 2000 (peak production) for 30 tracts (refer to Figure 1-1). Projected average annual coal production would be approximately .24 billion tons from 1985 through the year 2007 for 36 of the 39 tracts. The Hospah #1, Gallo Wash #2, and Hospah #2 tracts are projected to begin production in the years 2010, 2015, and 2020 respectively.

Construction would begin between 1984 and the year 2019. Surface and underground mines would require 4 and 6 years respectively for construction. Production would start during the second year of construction.

The total amount of surface disturbed on these tracts would be approximately 68,641 acres. Before reclamation, surface mining would disturb approximately 1,771 acres on 17 tracts in 1987, and 23,641 acres on 22 tracts in the year 2000. Approximately 3,500 acres of these tracts would be disturbed by onsite surface facilities, including coal and topsoil storage areas, haul and access roads, and power and telephone lines. Acres disturbed per year are shown in Table 1-4.

Approximately 3,465 construction workers would be required to bring the 39 tracts into production. As the mines came into production in the second year, a number of construction workers would be replaced by production and transportation workers.

AUTHORITIES FOR COAL LEASING AND DEVELOPMENT

This section presents an overview of the major laws that authorize the leasing of federal coal resources. The primary emphasis is on statutes that directly control leasing and mining activities. Other authorities dealing with site-specific decisions on coal development are cited in Appendices A-4 and A-5.

Mineral Leasing Act of 1920

This act provided that deposits of coal, phosphate, potassium, oil, oil shale, gas and sodium could be acquired through a leasing system. This law specifies, among other things, minimum royalties, acreage limitations, and the lease term required for each kind of leasable mineral.

Federal Coal Leasing Amendments Act of 1976 (FCLAA)

The broad purpose of the FCLAA is to provide a more orderly procedure for the leasing and development of coal presently owned by the United States. Among the most significant requirements of the FCLAA governing the awarding and development of federal leases are the following.

1. All leasing must be by competitive bidding; no bids can be accepted that do not equal or exceed fair market value.

2. Issuance of prospecting permits leading to non-competitive (preference right) leasing is abolished (subject to valid existing rights).

3. Leases may be consolidated into logical mining units (LMUs) when needed to insure maximum economic recovery of the coal deposit; all LMU reserves must be mined within 40 years.

4. Diligent development and continuous operation is required (except continuous operation may be waived upon payment of advance royalties).

5. Leases to a single entity are limited to 100,000 acres nationwide (as well as 46,080 acres in a particular state).

6. State shares of royalties were raised from 37 1/2 percent to 50 percent, with the new portion of the monies available not just for construction of roads and schools, but also for a wide range of specific services and facilities in impacted areas.

7. Public bodies were entitled to have reserved a reasonable number of leasing tracts for their own energy production.

Federal Land Policy and Management Act of 1976 (FLPMA)

The purpose of FLMPA is to provide the first comprehensive statutory statement of purposes, goals, and authority for the use and management of federally-owned lands administered by the Secretary of the Interior through the Bureau of Land Management. FLPMA included the following basic item.

1. Statutory framework for land-use planning for public lands.

2. Confirmation that the BLM may continue to rely on existing plans.

3. Liberation of the use of mineral revenues by states and local governments. FLPMA provided that the entire 50 percent of the funds received by the federal government for the development of leasable minerals on federal land could be used for any public purpose. FLPMA also established a program to provide low-interest loans to states and local governments impacted by federal land mineral-development activities.

4. The Department of the Interior (DOI) is required to review all BLM roadless areas of 5,000 acres or more (and roadless islands) for potential designation as wilderness.

Surface Mining Control and Reclamation Act of 1977 (SMCRA)

This act was passed in response to concern over the extensive environmental damage caused by coal mining, and because of the technological and economic changes that now favor surface over underground mining. SMCRA established uniform minimum federal standards for regulating surface mining and

reclamation activities throughout the country on federal, state, and private lands, and for ensuring adequate protection from the environmental impacts of surface mining in all states.

Other features of SMCRA relevant to the leasing and development of coal are:

1. Authority to exchange federal lands already under lease that have been included in an alluvial valley floor and are subject to the grandfather clause in Section 510(b)(5) of the act.

2. A requirement for the consent of certain private surface owners before the DOI can lease any federal coal under privately-owned land.

Mineral Leasing Act for Acquired Lands (MLAAL)

MLAAL governs coal leasing on federally acquired lands as well as the leasing of other minerals covered by the Mineral Leasing act. The MLAAL requires the consent of the head of the federal agency having administrative jurisdiction over the acquired lands before the BLM can lease the coal. Other leasing provisions for acquired lands are the same as those for non acquired lands, which are covered by the FCLAA.

UNSUITABILITY CRITERIA

It is the Department of the Interior's responsibility to carry out the review of federal lands for their suitability for coal mining. This review is conducted under Section 522(b) of the Surface Mining Control and Reclamation Act of 1977, principally through land use planning assessments.

Unsuitability criteria [found in Title 43 CFR 3461.1 (a) (1) through (t) (1)] have been applied to the PRLAs and competitive coal lease tracts addressed in this EIS. The results of this application are found in Table 1-5, with a general explanation as follows. Also as a result of this application tract-specific stipulations for the PRLAs have been developed; they appear in Appendix A-6. These or similar stipulations may be attached to any leases issued for the competitive coal lease tracts.

Criteria 5, 6, 8, 9, 10, 12, 13, 15, 17, 18, 19, 20

After consultation with the U.S. Fish and Wildlife Service (FWS) and the State of New Mexico, these criteria have been found to have no effect on the suitability of the PRLAs or competitive coal lease tracts to be mined.

Criteria 1, 2, 3, 4, 7, 11, 14, 16

These criteria have been applied and do affect the PRLAs and the competitive coal lease tracts. The following is a discussion of these criteria.

TABLE 1-5

PUBLIC LANDS UNSUITABLE FOR COAL MINING

Criterion	PRLA	Competitive Coal Tracts
#4 (Wilderness Study Areas)	A total of 320 acres of NM-11916 fall within the Bisti WSA, and 5,355 acres of NM-6804, NM-3919, NM-3918 fall within the Ah-shi-sle-pah WSA.[a/] A total of 7,749 acres of NM-6801, NM-3834, and NM-3838 overlap the De-na-zin WSAs where underground mining is allowed with no surface facilities or subsidence.	No Effect
#11 (Golden Eagle)	No Effect	A total of 75 acres for a nest and its buffer zone fall within the Johnson Trading Post Tract.
#14 (Ferruginous Hawk)	A total of 1,665 acres for four nesting sites exist within NM-3835, NM-3919, NM-11916 (refer to Appendix A-7).	A total of 115 acres of one nesting site occur within Bisti #4 (refer to Appendix A-8).

Note: [a/] The BLM has requested final showing information from the holders of all PRLAs, including those that overlap the Ah-shi-sle-pah WSA. However, no leases will be issued until after a final decision is reached on the status of this WSA.

Criterion 1

Portions of the Continental Divide National Scenic Trail study corridor traverse some of the coal tracts. The actual treadway for the Continental Divide National Scenic Trail has not been established. In view of this situation, this criterion does not require the proposed study corridor to be designated as unsuitable for surface coal mining.

Criteria 2, 3, and 16

The exceptions and or exemptions of these criteria have been applied to the PRLAs and competitive coal lease tracts. Special stipulations will be included in each lease permit to protect valid existing rights. For Criteria 16, special stipulations will be included after consultation with the Minerals Management Service to ensure that coal mining can be undertaken without substantial threat of loss to people or property.

Criterion 4

Wilderness Study Areas are unsuitabile for surface coal mining and no surface facilities or subsidence are allowed for underground mining. This criterion does not affect any of the competitive coal tracts, but it does affect seven PRLAs (refer to Table 1-5).

Criterion 7

As provided by the exception to this criterion [after consultation with the State Historic Preservation Officer (SHPO)], surface coal mining operations on tracts with identified sites will be allowed. However, this mining will be allowed only after the lessee carries out measures to avoid significant adverse impacts to the sites in accordance with a mitigation plan approved by the BLM.

Further, all of the subject lands will be required to be inventoried for cultural resources. Consultation between the BLM and the BIA, OSM, MMS, and SHPO, will occur to determine if located sites are eligible for inclusion on the National Register of Historic Places. If adequate mitigating measures cannot be devised for these sites the sites (and appropriate buffer zone), would not be surface mined.

Criteria 11 and 14

After consultation with the FWS, Criterion 11 has been found to affect one competitive coal tract, and Criterion 14 affects three PRLAs and one competitive coal tract (refer to Table 1-5).

SURFACE MINE RECLAMATION

Each surface tract would be developed under a mine plan. Figure 1-2 shows the general plan for a surface mine. Because these mines would disturb and reclaim areas in stages, only part of the potential mining area would be disturbed annually. Table 1-6 lists the acreage disturbed (by tract) and maximum area of land unreclaimed during the reclamation sequence. Figure 1-3 illustrates the reclamation sequence. It is assumed that areas disturbed for

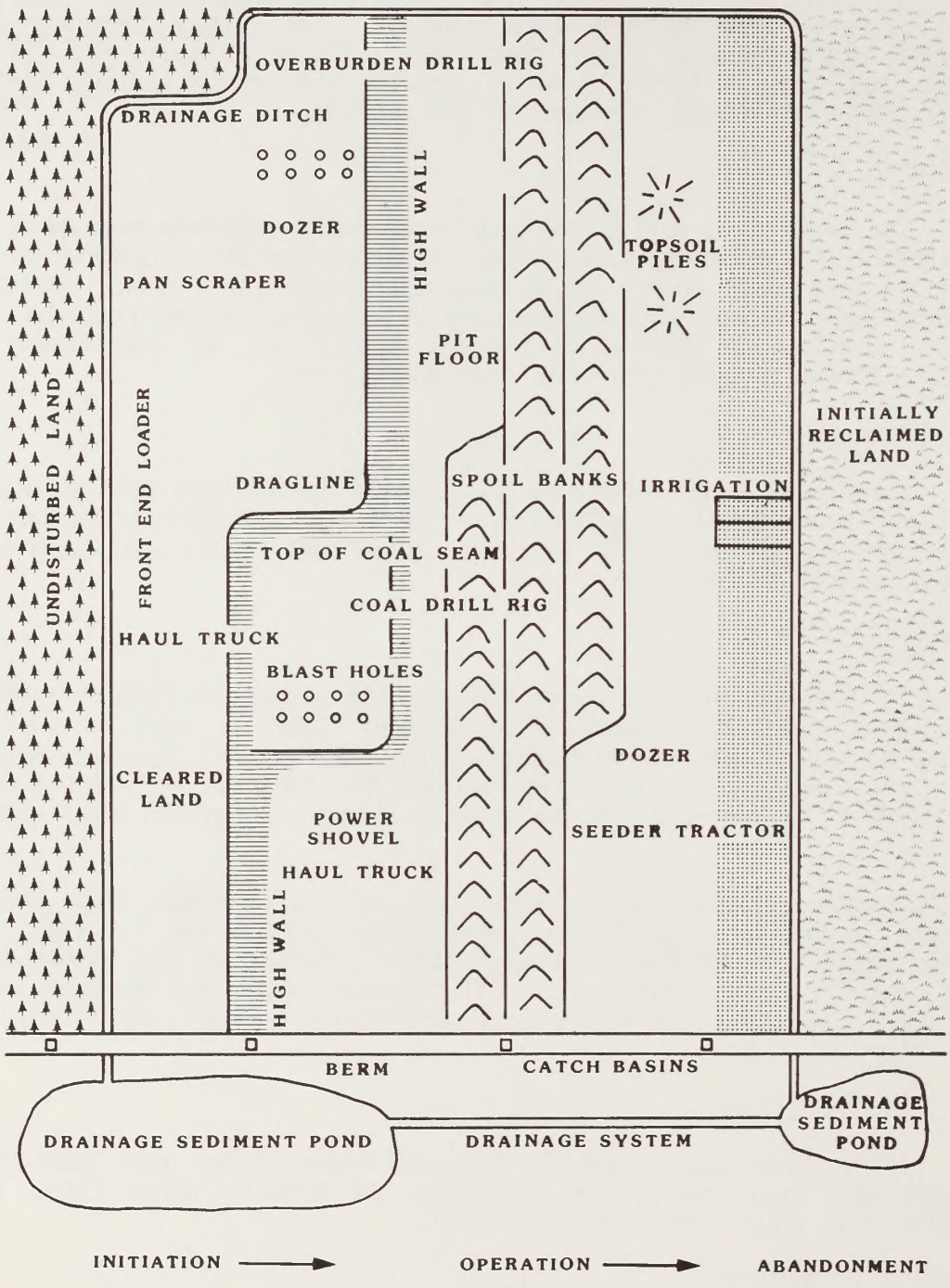


FIGURE 1-2

TIME-PHASED PLAN OF A SURFACE MINE

Source: USDI, BLM 1981e.

TABLE 1-6

ACREAGE DISTURBANCE BY SURFACE MINES AND FACILITIES
DURING VARIOUS STAGES OF THE MINING SEQUENCE

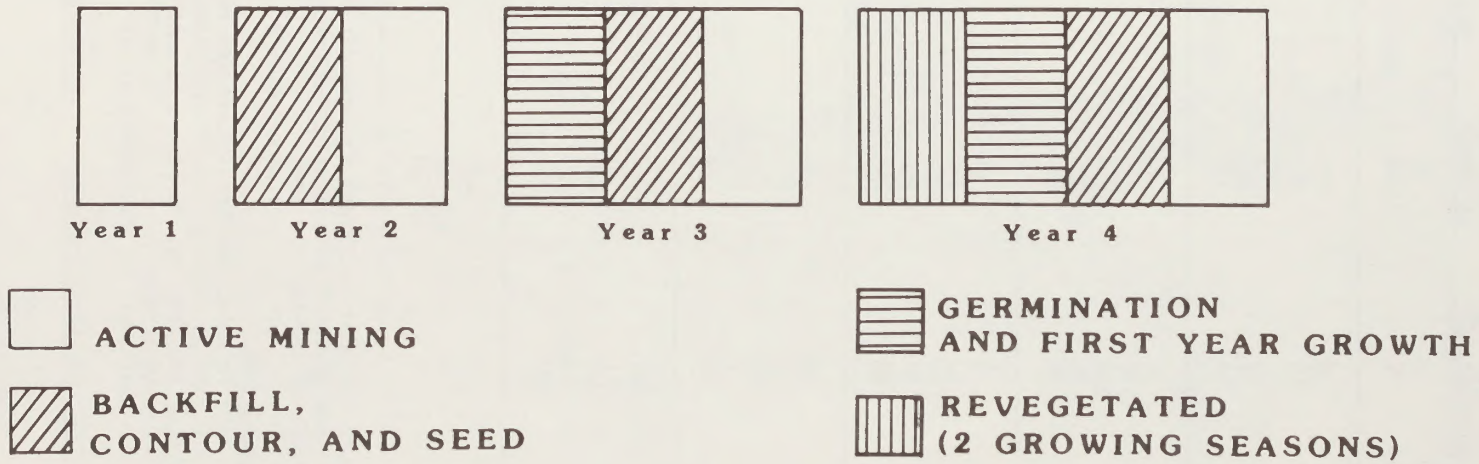
Tracts	Annual Disturbance from Mining[a]	Unreclaimed Mined Lands By Year[b]	Disturbance from Facilities[c], [d]	Maximum Unreclaimed Lands[e]
Underground (Average)	0	80	80	80
Surface Mine (Average)	78	234	100	334
La Plata #1	40	120	50	170
Star Lake West #2	65	195	100	295
Kimbeto #2	35	105	50	155
Gallo Wash #1	67	201	100	301
Bisti #6/8	40	120	50	170
Lee Ranch East	24	72	50	122
Lee Ranch Middle	148	444	200	644
Lee Ranch West	188	564	200	764
Divide	75	225	100	325
Hospah #1	80	240	100	340
Gamerco #1 (HC)	8	24	50	75
Bisti #4	60	180	100	280
Johnson Trading Post	86	258	100	358
Star Lake East #1	70	210	100	310
Bisti #1	89	267	100	367
Bisti #2	32	96	100	346
Catalpa Canyon	40	120	50	170
Sundance	23	69	50	119
Samson Lake #2/2	7	21	50	71
La Plata #3	16	48	50	98
Crownpoint Northeast	206	618	200	818
Crownpoint East (H/LC)	261	783	200	983
Chico Wash South	148	444	200	644
Hogback	43	129	50	179
Twin Buttes	250	750	200	950
Pinehaven	29	87	50	137
Bread Springs #1	6	18	50	68
Gamerco #1 (LC)	4	12	50	62

Notes:
[a] Beginning in 1987 and continuing for the life of the mine.
[b] Assumes 3-year period from initial disturbance by mining operations to establishment of vegetation cover.
[c] Continues through life of mine; shows average acre need for onsite and offsite facilities.
[d] These figures are predicted upon information on surface disturbance acreage from surface mines in the Uinta-Southwestern Utah and Bisti-Star Lake EIS, and from the Lee Ranch, Mentmore, and Star Lake Mine plans. Estimated acreage for on site and offsite facilities are as follows:
[e] Maximum area that would be unreclaimed at any one time.

Annual Mine Surface Disturbance	Acres Needed for Facilities
0-50 Acres	50
50-100 Acres	100
>100 Acres	200

Figure1-3

SURFACE MINE RECLAMATION SEQUENCE



Source: USDI, BLM 1981e.

underground mines and facilities would remain unreclaimed for the life of the mine, although reclamation would be required after facilities were removed.

As shown in Figure 1-3, vegetation would be established within 3 years on the acreage disturbed initially. This does not imply that a total return to original vegetation would occur in that time period, but vegetation cover sufficient to retard wind and water erosion of soil would be established. Depending upon the original vegetation type on each tract, restoration to original conditions could require a much longer period of time (15 to 20 years or more).

A detailed surface mining and reclamation plan based on permanent program performance standards for surface mining (30 CFR 816) must be submitted to and approved by the State of New Mexico's Energy and Minerals Division in cooperation with the federal Office of Surface Mining (OSM). A site-specific environmental analysis of the mine plan will be prepared by the OSM. The State of New Mexico will then issue a permit to mine and will over see the reclamation work with the cooperation of the Mineral Managment Service (MMS).

The BLM also develops special reclamation requirements included in federal coal leases and in mining and reclamation plans. These special requirements are related to the management and protection of all resources other than coal, and to the post-mining land uses of the affected public lands.

MAJOR ISSUES

As a result of public comment during the scoping and consultation proces for this EIS, a number of specific issues have surfaced. The following sections give a brief overview of the major issues of public concern; these issues are discussed in greater detail in Chapters 2 and 3.

Air Quality

The major issues concerning air quality are the increase in total suspended particulates (TSP) over federal and state ambient air quality standards, and the general degradation of air quality over the Chaco Culture National Historical Park.

Water Resources

Questions and concerns about water quantity and quality were major points of discussion. Numerous participants stated that the San Juan River was currently over-allocated, and any additional water use could have severe impacts to downstream users. The alternative of using ground water or water from uranium mines was also a controversial topic. Potential adverse impacts from ground water drawdown were described, as well as a fear that water from uranium mines would not be adequately treated and radionucleides could be introduced to plants and their environment. Numerous questions were also raised about possible impacts to water quality caused by acid deposition from the proposed plants, coal mine runoff, and other activities in the area.

Soils and Reclamation

Reclamation concerns centered around whether or not the subject lands could be reclaimed, and if so, whether or not the timeframes and costs involved in reclamation are reasonable. Many individuals felt that the mined lands could never be reclaimed to their former production capabilities. Livestock productivity is a spin-off of this central issue, as are water quality and erosion in the Region. Some impacts on these resources will depend upon the success of revegetating the reclaimed land. A few individuals feel that revegetation could take place and could be completed without the use of irrigation.

Paleontology

Members of the scientific community and the general public expressed concern about the loss of significant fossils and information from the mined areas. While others from the community felt that mining would allow for the extraction of scientific data that would not be available if mining did not occur.

Cultural Sites

Numerous comments were received expressing concern over the destruction of uninventoried archaeological sites, vandalism, and the collection of artifacts because of the ease of access to the sites in the region. Concerns also centered around the destruction of structures within Chaco Cultural National Historic Park, some Chacoan Outliers, and uninventoried structures due to blasting. Some individuals felt these impacts could be mitigated.

Recreation, Wilderness, and Visual Resource Management

It was felt that mining and associated activities would be detrimental to the visual quality of the region. Further, these activities would distract from the the quality of experience in the Wilderness Study Areas (WSAs), and limit the recreation opportunities in the badlands near and overlying the coal tracts. Noise would be especially distracting to visitors participating in these activities.

Wildlife

Major issues surfaced concerning the destruction of habitat and nesting sites for golden eagles, ferruginous hawks, and prairie falcons (species of high federal interest) by mining and related activities. Concern was also expressed regarding destruction of deer and elk winter range, increased road kills, and illegal shooting of these animals.

Transportation and Rights-of-Way

The issues concerning transportation center on the increased demand on the existing network of roads caused by mine and facility development. The corresponding increase in road maintenance costs, design problems, and potential for conflicting use are also topics raised. Other issues include how the location of transmission lines, pipelines, and other utility corridors would affect existing land practices and the region's visual quality (landscape character).

Social and Economic Factors

Public Revenues and Costs

The main issue raised here is whether or not local governments can handle the rapid population growth associated with facility construction and mining, and the pressures that this type of rapid growth will put on public services. In general, public revenues lag behind public costs by 2 to 3 years during periods of rapid economic development. Costs generated by population growth often exceed the revenues in the first few years of development, creating funding issues that can be difficult to resolve.

Inflation

Short-term inflationary pressure from economic developments is a major issue that is most likely to occur in smaller, less developed trade areas. In these locations the increases in demand for housing, food, clothing, and other needs strain the local supply or distribution systems. However, long-term inflationary impacts would also be an issue, because an operations work force would be located in an area for the 30- to 40-year life of the mine, and individuals not sharing in the economic benefits of development would be at a relative disadvantage in competing for goods and services.

Lifestyle Changes

The basic issue concerning the lifestyle of small communities is the long-term social changes that will occur in conjunction with coal development. The change in the power and economic base of affected communities, with ranching losing some of its dominance to industry, is also an issue. However, this may be offset by the increase in local employment opportunities and the reversal of the trend of outward migration from many small communities. Another issue is the perceived impact to public health and safety from air and water pollution associated with coal development facilities.

American Indian Concerns

Many of these issues centered around impacts to American Indian lifestyle, and were similar to the issues discussed above. Other concerns surfaced regarding the hindrance of religious practices through the destruction of sacred sites, gathering areas, and graves. One of the major issues in this EIS is the relocation of occupants; how, when, where, and what are the social implications of the relocation of a people with a traditional lifestyle. The loss of grazing privileges over an extended period of time is also a major concern, because grazing of small herds and flocks is a part of the lifestyle of the Navajo people.

INTERRELATIONSHIPS WITH OTHER PROJECTS IN THE REGION

In addition to the alternatives analyzed in this EIS, two other actions are pending before the BLM that could be approved instead of parts of the alternatives. The first of these actions is a selection that the Navajo Tribe has made of 35,000 acres of public lands (refer to Appendix A-9 for a list of these lands). The selection seeks both the surface and mineral estates under

Section 11 of the Navajo Hopi Relocation Amendments Act of 1980 (P.L. 96-305), which allows the Navajo Tribe to select up to 250,000 acres of public land within 18 miles of the current reservation boundary. Up to 35,000 acres of this land can be in New Mexico. The purpose of the selection is to provide a residence area for Navajos relocated from lands in Arizona as part of this settlement of a land dispute between the Hopi and Navajo Indian Tribes. The selection itself is exempt from the environmental requirements of the National Environmental Policy Act of 1969.

The Department has this selection under active consideration but has not decided to approve the selection. Before the selection application was filed, however, the New Mexico State Director of the BLM informed the chairman of the Navajo Tribe that if the Tribe selected lands covered by PRLAs, the interests conveyed by the PRLAs would not be transferred as part of the selection. Any leases issued would be administered by the BLM, and all revenues would be distributed under the Mineral Leasing Act.

If the selection was approved as made, it is not clear how the environment would be affected. The Navajo Tribe could allow development to proceed as proposed by the PRLA holders, causing impacts already analyzed by the BLM. Alternatively, the Navajo Tribe could begin an active relocation program that could delay or interfere with proposed surface coal mining operations, greatly reducing mining and its related impacts.

The second pending action is Santa Fe Mining Company's proposal to exhange fee coal interests it owns for coal owned by the United States. Both the United States' and Santa Fe's coal interests are within the lands currently delineated as the Lee Ranch West, Middle, and East tracts and the Divide Tract located in the southern part of the EIS Region. The coal in these tracts is owned largely in a checkerboard pattern with the United States owning the odd numbered sections and Santa Fe owning the even numbered sections.

Santa Fe's proposal is to consolidate its coal ownership in the Lee Ranch Middle Tract, while the United States would consolidate its ownership in the Lee Ranch East, West, and Divide tracts. (Maps of this proposal are on file in the Albuquerque District and Farmington Resource Area Office). The exchange would be and equal value exchange as allowed by Section 206 of the Federal Land Policy and Management Act of 1976.

Because this proposal was made so late in the writing of this EIS a full review of its effects has not been completed, but will be available along with the Final EIS. Preliminary analysis does not show any significant environmental differences between leasing as proposed and leasing under the exchange, because the same lands would be available for development under generally the same environmental protection provisions.

Another proposal involves a total of 1,690 acres on two PRLAs and two competitive lease tracts, these acres are included in the Ute Mountain Exchange Withdrawal (Federal Register/Vol. 47, NO. 43/Thursday, March 4, 1982). The Ute

Mountain Withdrawal reserves the public lands for use in a proposed surface estate exchange between the Public Service Company of New Mexico (PNM) and the BLM. The withdrawal segregates the public lands from the opertions of public land laws and the general mining laws. A period of 2 years from the publication of the withdrawal in the Federal Register is allowed for consummation of the surface exchange. Impact analysis for this proposed exchange can be found in the Final Ute Mountain Land Exchange Environmental Assessment (USDI, BLM 1980).

A total of 1,278 acres of the PRLAs and competitive lease tracts are within the Navajo Exchange Withdrawal. The Navajo Exchange lands were withdrawn on September 2, 1980 by 43 CFR Public Land Order 5721, published in the Federal Register (Vol. 45, No. 87, pages 29295-29297). P.L.O. 5721 withdrew 67,000 acres of public land, reserving them for use in a proposed surface estate exchange between the BLM and the Navajo Tribe. These lands were withdrawn from settlement, sale, location, or entry under the general land laws and the mining laws until consummation of the exchange. Legislation has been passed (October, 1982) to transfer the public land to the Navajo Tribe. Impact analysis for this proposed exchange can be found in the Final Environmental Assessment Record on Proposed Navajo Land Exchange (USDI, 1978).

The entire Bisti #1 Tract (approximately 3,713 acres) is under the Bisti Coal Lease Exchange. Public law 96-475 (94 Stat. 2269), dated October 19, 1980, authorized the Secretary of the Interior to issue coal leases within the Bisti #1 Tract upon relinquishment of the leases or portions of leases lcoated within the Bisti Wilderness Study Area. Following the enactment of this act, 30 months are allowed for completion of the lease exchange. Impact analysis for this proposed exhange can be found in the Draft Bisti Coal Lease Exchange Environmental Assessment (USDI, BLM 1982).

SUMMARY OF IMPACTS FROM MINING ON THE PRLAS (NO ACTION ALTERNATIVE)

Table 1-7 summarizes the impacts from mining the 26 PRLAs and other projects that are part of the No Action Alternative (existing and proposed mines under contract commitments or mine plans, and major federally approved projects. For PRLAs impacts are shown for 1987 and the year 2000 in order to compare the impacts of the PRLAs to the impacts of the other alternatives for the same years. The impacts are for only thsoe years; they are not cumulative. For the other projects, impacts between the years 1987 and 2000 are assumed to remain the same.

The figures in the PRLA "Total" column and the "Other Projects" column in Table 1-7 were combined to show the total impacts for the No Action Alternative in Table 1-8.

COMPARISON OF THE IMPACTS OF THE ALTERNATIVES

This section discusses those resource values that would be significantly impacted by coal mining under each of the alternatives. Table 1-8 gives the magnitude of these impacts by alternative. The alternatives would produce impacts generally commensurate with the amount of coal produced. The alternatives differ very little from one another by the nature of their impacts; they differ mostly in the magnitude of the impacts they would produce. The cumulative impacts of new federal coal leasing would be the impacts of a particular alternative added to the impacts of the No Action Alternative.

TABLE 1-7

SUMMARY, NO ACTION ALTERNATIVE IMPACT

Resource Impacted	PRLAs Total	PRLAs 1987 [b]	PRLAs Year 2000 [b]	Other Projects Total
Air Quality [a]	Approximate TSP concentration is 100 ug/m^3.			Air Quality level is considered as part of the existing environment.
Topography, Geology, Mineral Resources	Surface mine and deep mine-site alteration of topography on over 22,022 acres. Removal of about 1.15 billion tons of coal.	Removal of approximately 1.6 million tons of coal.	Removal of approximately 20.5 million tons of coal.	Alteration of topography on approximately 9,243 acres. Removal of up to 60 million tons of coal.
Paleontology	An estimated known 1,009 fossil collecting sites would be destroyed by construction of mining-connected facilities. Population increases and increased access to the Region would result in unauthorized collection and vandalism. However, during mining, subsurface information would become available.			The type of impacts are the same as those that would occur under the PRLAs, except that no known fossil collecting areas have been estimated.
Soils	About 705 acres removed from production by facilities construction, resulting in long-term productivity loss. Over 22,022 acres disturbed by surface mining, resulting in short-term acceleration of erosion and sediment yield.	Approximately 1,500 acres disturbed by surface mining.	Approximately 10,000 acres disturbed by surface mining.	Nearly 9,243 acres disturbed by other projects.
Water Resources	Disruption of aquifers and destruction of shallow ground water sources, less recharge to ground water, and use by mining companies of 12,850 acre-feet of water per year. Destruction of existing drainage patterns in mined areas.	6,425.0 acre-feet [c]	12,850 acre-feet [d]	Disruption of aquifers and destruction of shallow ground water sources, less recharge to ground water, and use by mining companies of 1,700 acre-feet of water per year. Destruction of existing drainage patterns in mined areas.
Vegetation	Temporary removal of vegetation on approximately 22,022 acres.	Temporary loss of vegetation on approximately 651 acres.	Temporary loss of vegetation on approximately 9,113 acres.	Temporary loss of vegetation on approximately 9,118 acres.

TABLE 1-7

SUMMARY, NO ACTION ALTERNATIVE IMPACT (CONTINUED)

Resource Impacted	PRLAs Total	PRLAs 1987 b/	PRLAs Year 2000 b/	Other Projects Total
Livestock Grazing and Improvements	Yearly vegetation production on the 22,022 acres to be disturbed is estimated at 2,041 AUMs. Short-term annual AUM losses cannot be predicted until mine plans are submitted. Vegetative yield should return to or near full production in the long term. Ten dirt reservoirs, 2 wells, 2 windmills and 20.5 miles of fence would be destroyed.	Type of impacts similar to total impacts, except 58 AUMs would be disturbed on 651 acres.	Type of impacts similar to total impacts, except 819 AUMs would be disturbed on 9,113 acres.	Type of impacts similar to those indicated for PRLAs (Total), except yearly forage production on the 9,243 acres to be disturbed is estimated at 2,150 AUMs.
Wildlife	Surface mining would exclude about 22,022 acres from use by wildlife until after reclamation. Underground mining would reduce wildlife numbers through excluding wildlife from (and reducing use on the vicinity of) the approximately 705 acres that would be needed for surface facilities. Indirect impacts on wildlife due to increase of human activity in region would occur. Disturbance to species of high federal interest would occur (4 ferruginous hawks) and 1 prairie falcon.	Type of impacts similar to total impacts, except wildlife habitat would be lost on 651 acres until after reclamation. Some impact could occur to raptors due to increase in human activity near nest sites.	Type of impacts similar to total impacts, except wildlife habitat would be lost on 9,113 acres. Adverse impacts to nesting sites of 4 high federal interest raptors would occur due to increase in human activity near nesting sites.	Surface disturbance would exclude 9,243 acres from use by wildlife until after reclamation.
Cultural Resources	A total of 171 sites have been identified throughout the PRLA Area and 542+ have been predicted. Site excavations and other forms of data recovery prior to mining would result in increased knowledge about past cultures, although tight time-frames could affect the quality of data recovered. Unmitigated sites and roads in surface mining areas would be destroyed. Mining-related activities and population increases would accelerate damage.			Other projects may destroy betweenk 126 and 174 sites. Type of impacts similar to those of PRLAs (Total) would also occur on acres disturbed by other pro- jects.

TABLE 1-7

SUMMARY, NO ACTION ALTERNATIVE IMPACT (CONTINUED)

Resource Impacted	PRLAs Total	PRLAs 1987 [b]	PRLAs Year 2000 [b]	Other Projects Total
Visual Resources	Mining, construction, and use of related facilities would result in reductions in scenic value for 20 to 40 years or longer.			Mining, construction, and use of related facilities would result in reductions in scenic value for 20 to 40 years or longer.
Wilderness	Outside noise and visual disturbance would impact the quality of the wilderness experience within the Wilderness Study Areas.			Outside noise and visual disturbance would impact the quality of the wilderness experience within the Wilderness Study Areas.
Recreation	Impacts would include an increase in the local demand for recreation, increased pressures on other recreation areas due to population growth, and removal of lands from recreation use due to mining operations. Activities from mining would detract from the quality of recreation experience.			Impacts would include an increase in the local demand for recreation, increased pressures on other recreation areas due to population growth, and removal of lands from recreation use due to mining operations. Activities from mining would detract from the quality of recreation experience.
Land Uses	Nearly 379 acres (54 miles) of rights-of-way could be destroyed or rerouted.	Nearly 5.5 acres of rights-of-way could be disturbed	Nearly 96.4 acres of rights-of-way could be disturbed.	Data not available
Transportation [d]	Increase in accidents, daily traffic, and need for road maintenance. An average daily traffic increase of 4,190 on local highways and an increase of nearly 89 accident would occur.	The 1980 base figure for highways on which the information was available is 7,346 ADT. An average Daily Traffic (ADT) increase of 258 on local highways and an increase of nearly 5 accidents per year would occur.	The 1980 base figure for highways on which the information was available is 7,346 ADT. An average Daily Traffic (ADT) increase of 4,190 on local highways and an increase of nearly 89 accidents per year would occur.	Increase in accidents, daily traffic, and need for road maintenance.
Social and Economic Factors	Population would increse by as much as 1,923 people (116%) in Cuba. The base figure for population at the year 2000 is 90,600 people. Total employment could increase by up to 5,191 jobs (16%) in Farmington and 1,731 jobs (324%) in Cuba.	Population would increase by 1,271 people (131%) in Cuba. Employment would increase by 4,973 jobs (18%) in Farmington and 1,144 jobs (33%) in Cuba.	Population would increase by 1,923 people (116%) in Cuba. Employment would increse by 5,191 jobs (16%) in Farmington and 1,731 jobs (324%) in Cuba.	Lifestyles and cultural and religious values for Navajo people living on or near the projects would be disrupted. Expansion of community infrastructures would be necessary.

TABLE 1-7

SUMMARY, NO ACTION ALTERNATIVE IMPACT (CONCLUDED)

Resource Impacted	PRLAs Total	PRLAs 1987 b/	PRLAs Year 2000 b/	Other Projects Total
Social and Economic Factors (Cont'd)	The base figure for employment at the year 2,000 is 41,096 jobs. Lifestyles and cultural and religious values for Navajo people living on or near the PRLA would be disrupted. Expansion of community infrastrutures would be necessary.			
American Indian Concerns				
Residences	Approximately 55 Navajo American Indian families occupying the PRLAs and adjacent land would have to be relocated,			Data not available
Gravesites	Eleven known graves known and many others in surface mining areas could be disturbed if not identified and removed before mining. The belief in witchcraft occurring due to grave disturbance would have effect on Navajo health and behavior. It is possible to reduce or eliminate affects through ceremonies.			Data not available.
Sacred Sites	Four known sacred sites not recognized before mining could be destroyed by surface mining and by facilities construction. Population increases, noise, vibration, and dust from mining would cause adverse effects to site users. It is possible to reduce or eliminate the affects through ceremonies.			Data not available.

a/ State 24-hour ambient air quality standard limit is 150 ug/m^3.
b/ Impacts are the same as those discussed in the total impacts. They differ only in intensity.
c/ Assuming 3 of the PRLA units go into production in 1987 (Arch. Unit #1, Thermal Peabody, Freeman United).
d/ Assuming all PRLAs are in production by the year 2000.

TABLE 1-8

COMPARISON OF IMPACTS, ALL ALTERNATIVES

Resource	No Action	Bypass	Minimum Surface Owner Conflicts	Target [b]	High [c]
Air Quality [a] (New Mexico State TSP 24-hour Ambient Air Quality Standard is 150 ug/m^3	Approximate TSP concentration is 100 ug/m^3	Would exceed New Mexico State 24-hour ambient air standard by 13 ug/m^3.	Would exceed New Mexico State 24-hour ambient air standard by 84 ug/m^3.	Would exceed New Mexico State 24-hour ambient air standard by 84 ug/m^3.	Would exceed New Mexico State 24-hour ambient air standards by 86 ug/3.
Topography, Geology, Mineral, Resources	Alteration of topography on 31,970 acres. Some subsidence on up to 67,081 acres. Removal of up to 1.75 billion tons of coal.	Alteration of approximately 6,130 acres. Removal of approximately 282.0 million tons of coal (113 million tons federal). No subsidence.	Alteration of approximately 19,302 acres. Removal of approximately 702.0 million tons of coal (349 million tons federal). Subsidence on up to 21,000 acres.	Alteration of approximately 35,977 acres. Removal of approximately 1.2 billion tons of coal (696 million tons federal). Subsidence on up to 21,000 acres.	Alteration of approximately 68,641 acres. Removal of approximately 1.65 billion tons of coal (1.09 billion tons federal). Subsidence on up to 37,081 acres.
Paleontology	An estimated 1,009 fossil localities detroyed by construction of mining-connected facilities. Population increases and increased access to the region would result in unauthorized collection and vandalism. However, During mining subsurface information would become available.	An estimated 570 fossil localities disturbed. Other impacts the same as under the No Action Alternative.	An estimated 136 fossil localities disturbed. Other impacts the same as under the No Action Alternative.	An estimated 1,493 fossil localities disturbed. Other impacts the same as under the No Action Alternative.	An estimated 1,693 fossil localities disturbed. Other Impacts the same as under the No Action Alternative.
Soils	About 705 acres removed from production by facilities construction, resulting in long-term productivity loss. Over 31,970 acres disturbed by surface mining with short-term acceleration of erosion and sediment yield resulting. Soil mixing, contamination and compaction would also occur.	About 6,130 acres disturbed by surface mining, and 600 acres by underground mining and surface facilities. Type of impacts the same as under the No Action Alternative.	About 19,302 acres disturbed by surface mining, and 650 acres by underground mining and surface facilities. Type of impacts the same as under the No Action Alternative.	About 35,977 acres disturbed by surface mining, and 1,700 acres by underground mining and surface facilities. Type of impacts the same as under the No Action Alternative.	About 68,641 acres disturbed by surface mining, and 2,700 acres by underground mining and surface facilities. Type of impacts the same as under the No Action Alternative.

TABLE 1-8 (Cont'd)

Resource	No Action	Bypass	Minimum Surface Owner Conflicts	Target [b]	High [c]
Water Resources	Disruption of aquifers and destruction of shallow ground water sources, less recharge to ground water, and use by mining companies of 12,850 acre-feet of water per year. Destruction of existing surface drainage patterns in mined areas.	Approximately 380 acre-feet of water per year used during mining process. Other impacts the same as under the No Action Alternative.	Approximately 2,500 acre-feet of water per year used during mining process. Other impacts the same as under the No Action Alternative.	Approximately 3,700 acre-feet of water per year used during mining process. Other impacts the same as under the No Action Alternative.	Approximately 4,650 acre-feet of water per year used during mining process. Other impacts the same as under the No Action Alternative.
Vegetation	Removal of vegetation on approximately 31,718 acres.	Removal of vegetation on approximately 6,130 acres.	Removal of vegetation on approximately 19,302 acres.	Removal of vegetation on approximately 35,977 acres.	Removal of vegetation on approximately 68,641 acres.
Livestock Grazing and Improvements	Yearly vegetative production on 31,970 acres disturbed estimated at 4,191 AUMs. Short-term annual AUM losses cannot be predicted until mine plans are submitted. Vegetative yield should return to or near full production in the long term. Ten dirt reservoirs, 2 wells, 2 windmills and 20.5 miles of fence destroyed.	An estimated 603 AUMs lost, with 4 reservoirs and 2 miles of fence destroyed or removed and 1 well.	An estimated 4,268 AUMs lost, with 9 reservoirs and 13 miles of fence destroyed or removed, 6 wells and 1 spring.	An estimated 6,045 AUMs lost, with 15 reservoirs and 31 miles of fence removed or destroyed. 19 wells and 1 spring. State sensitive species Astragalus wingatus impacted.	An estimated 9,977 AUMs lost, with 28 reservoirs, 73 miles of fence and a corral removed or destroyed. 17 wells and 1 spring. State sensitive species Astragalus wingatus impacted.
Wildlife	Surface mining to exclude about 31,970 acres from use by wildlife until after reclamation. Underground mining to reduce wildlife numbers through excluding wildlife from (and reducing use on the vicinity of) 705 acres needed for surface facilities. Indirect impacts on wildlife due to increased human activity in region. Possible disturbance to a raptor of high federal interest, 4 ferruginous hawks and 1 prairie falcon.	An estimated 6,130 acres removed from wildlife utilization, and 200 acres of deer and elk winter range disturbed. Possible disturbance of 1 ferruginous hawks and nesting areas.	An estimated 19,302 acres removed from wildlife utilization during mine life. Possible disturbance on 200 acres of wintering mule deer and elk range.	An estimated 35,977 acres removed from wildlife utilization during mine life. Possible disturbance of a golden eagle and 1 ferruginous hawk and nesting site.	An estimated 68,641 acres removed from wildlife utilization during mine life, and 300 acres of mule deer and elk winter range impacted. Possible disturbance of a golden eagle nest and 1 ferruginous hawk and nesting area.

TABLE 1-8 (Cont'd)

Resource	No Action	Bypass	Minimum Surface Owner Conflicts	Target [b]	High [c]
Cultural Resources	A total of 171 sites identified throughout the PRLA Area and 542+ predicted. Other projects may destroy between 126 and 174 sites within the competitive coal lease tracts. Site excavations and other forms of data recovery prior to mining would result in increased knowledge about past cultures in the region, although timeframes could affect the quality of data recovered. Unmitigated sites and roads in surface mining areas destroyed. Mining-related activities and population increases would accelerate damage.	A total of 13 sites identified, with 165 to 188 sites predicted. Portions of Chacoan roads destroyed. Other impacts the same as under the No Action Alternative.	A total of 142 sites identified, with 600 to 708 sites predicted. Portions of Chacoan roads destroyed. Other impacts the same as under the No Action Alternative.	A total of 185 sites identified, with 812 to 1098 sites predicted. Portions of Chacoan roads destroyed. Other impacts the same as under the No Action Alternative.	A total of 231 sites identified, with 1,727 to 2,295 sites predicted. Portions of Chacoan roads destroyed. Other impacts the same as under the No Action Alternative.
Visual Resources	Mining, construction, and use of related facilities would reduce the scenic values on 31,970 acres during a period of 20 to 40 years and longer. Impacts would occur to the Continental Divide National Scenic Trail corridor.	An estimated 6,130 acres would be affected in the same way as under the No Action Alternative. Significant impacts would occur to 3,040 acres in Bisti Badlands (VRM Class III - IV).	An estimated 19,302 acres (VRM Class III - IV) would be affected in the same way as under the No Action Alternative.	An estimated 35,977 (VRM Class III - IV) acres would be affected in the same way as under the No Action Alternative. Significant impacts would occur to 4,070 acres in Bisti Badlands.	An estimated 68,641 (VRM Class III- IV) acres would be affected in the same way as under the No Action Alternative. Significant impacts would occur to 4,070 acres in Bisti Badlands.
Wilderness	Mining and associated activities would detract from the quality of the wilderness experience due to noise and visual distractions.	Impacts the same as under the No Action Alternative.	Impacts the same as under the No Action Alternative.	Impacts the same as under the No Action Alternative	Impacts the same as under the No Action Alternative.

TABLE 1-8 (Cont'd)

Resource	No Action	Bypass	Minimum Surface Owner Conflicts	Target [b]	High [c]
Recreation	Increased demand for recreation in the region, increased pressures on outside recreation areas due to population increase, and extraction of land from recreation use due to mining operations. Mining activities would detract from the quality of the recreation experience due to noise and visual impacts.	Impacts the same as under the No Action Alternative.	Impacts the same as under the No Action Alternative.	Impacts the same as under the No Action Alternative.	Impacts the same as under the No Action Alternative.
Land Use	Removal or relocation of nearly 379 acres of rights-of-way, including roads, powerlines, pipelines, transmission lines and railroads.	An estimated 13 acres affected; type of impacts the same as under the No Action Alter- native.	An estimated 205 acres affected; type of impacts the same as under the No Action Alternative.	An estimated 363 acres affected; type of impacts the same as under the No Action Alternative.	An estimated 811 acres affected; type of impacts the same as under the No Action Alternative.
Transportation	Increases in accidents, daily traffic, road maintenance, and new road construction. Accidents increased by more than 89, and Average Daily Traffic (ADT) by more than 4,190 in the year 2000.	Accidents increased by more than 5, and ADT by more than 310 in the year 2000.	Accidents increased by more than 8, and ADT by more than 2,643 in the year 2000.	Accidents increased by more than more 36, and ADT by more than 3,310 in the year 2000.	Accidents increased by more than 62, and ADT by more than 4,397 in the year 2000.
Social and Economic Conditions	Population would increase by 1,923 people (116%) in Cuba in the Year 2000. Employment would increase by 5,191 jobs (16%) in Farmington and 1,731 jobs (324%) in Cuba in the year 2000. Lifestyles and cultural and religious values for Navajo people living on or near the PRLA's would be disrupted. Expansion of community infrastructures would be necessary.	Population would increase by 217 people (13%) in Cuba in the year 2000. Employment would increase by 195 jobs (36%) in Cuba in the year 2000. Other impacts would be the same type as under the No Action Alternative.	Population would increase by 2,977 people (15%) in Grants and 2,977 (31%) in Milan in the year 2,000. Employment would increase by 3,070 jobs (10%) in Farmington, by 2,680 (33%) in Grants, and 2,680 (102%) in Milan in the year 2000. Other impacts would be the same type as under the No Action Alternative.	Population would increase by 859 people (52%) in Cuba, 3,525 (17%) in Grants, and 3,525 (53%) in Milan in the year 2000. Employment would increase by 5,136 jobs (16%) in Farmington, 773 (145%) in Cuba, 3,172 (40%) in Grants, and 3,172 (121%) in Milan in	Population would increase by 2,573 people (155%) in Cuba, 4,230 (21%) in Grants, 5,481 (21%) in Gallup, 4,230 (64%) in Milan, and 3,342 (110%) in Crownpoint/Thoreau. Employment would increase by 4,005 jobs (13%) in Farmington, 2,156 (403%) in Cuba,

TABLE 1-8 (Cont'd)

Resource	No Action	Bypass	Minimum Surface Owner Conflicts	Target [b]	High [c]
Social and Economic Conditions (Cont'd)				the year 2000. Other impacts would be the same type as under the No Action Alternative.	3,807 (47%) in Grants, 4,454 (56%) in Gallup, 3,807 (145%) in Milan and 3,008 (655%) in Crownpoint/Thoreau. Other impacts would be the same type as under the No Action Alternative.
American Indian Concerns					
Residences	Approximately 55 Navajo American Indian families occupying the PRLA Area and adjacent land relocated.	Four known occupants (Navajo) relocated.	Twenty-three known occupants (Navajo) relocated.	Seventy known occupants (Navajo) relocated.	Four hundred fifty-five known occupants (Navajo) relocated.
Gravesites	Eleven known gravesites in surface mining areas disturbed if not identified and removed before mining. Belief in witchcraft occurring due to gravesite disturbance could have a profound effect on Navajo health and behavior.	On 3 known gravesites, impacts the same type as under the No Action Alternative.	No known gravesites, impacts the same type as under the No Action Alternative.	On 23 to 33 known gravesites, impacts the same type as under the No Action Alternative.	On 25 to 35 known gravesites, impacts the same type as under the No Action Alternative.
Sacred Sites	Four sacred sites destroyed by surface mining and facilities construction if not recognized ahead of time. Population increases and noise, vibration, and dust from mining would cause adverse effects.	On one known sacred site impacts the same type as under the No Action Alternative.	No known sacred sites, impacts the same type as under the No Action Alternative.	On three known sacred sites, impacts the same as type as under No Action Alternative.	On four known sacred sites, impacts the same type as under the No Action Alternative.

Notes: [a] Figures for air quality are cumulative, they include the No Action Alternative.
[b] The intensity and duration of impacts are greater than that of the No Action Alternative.
[c] The intensity and duration of impacts are greater than that of the Target Alternative.

Air Quality

No significant impact would occur to air quality as a result of the No Action Alternative. However, by adding the additional tracts of the Bypass Alternative, cumulative impacts would cause the state 24-hour ambient air standards to be slightly violated. With the addition of the tracts under the Minimum Surface Owner Conflicts (MSOC) Alternative, this standard would be significantly exceeded (by 84 ug/m^3). Additional mining on the tracts of the Target and High Alternatives would show very little increase over the MSOC Alternative.

Topography, Geology, Mineral Resources

Each alternative shows a marked increase in the total number of acres of land disturbed and coal removed as a result of mining. The numbers nearly triple from the Bypass to MSOC Alternative, and double from the MSOC to the Target and from the Target to the High Alternative.

Paleontology

The development of coal would result in the destruction of important fossil localities. However, some individuals feel that mining would allow for the extraction of scientific data that would not be available if the tracts are not mined. Population increases and access to EIS Region would result in unauthorized collection and vandalism. The Bypass Alternative would disturb an estimated 570 sensitive fossil localities. While the number of localities disturbed would nearly triple under the Target Alternative, the MSOC Alternative would affect only 136 fossil localities.

Soils

Soil disturbance would destroy sigificant numbers of acres under each alternative. The acreage removed from production by facilities construction would result in long-term productivity loss. On the acreage being disturbed by surface mining, short-term acceleration of erosion and sediment yield increases would result. Soil mixing, contamination and compaction would occur during mining operations.

Water Resources

Degradation of the quality of shallow ground water sources is expected to occur, and recharge of ground water would be decreased by mining. Each alternative shows that the mining process would utilize more acre-feet of water per year. The largest increase is between the Bypass and the Target Alternative. An additional concern relates to the possible decrease in water quality caused by acidic deposits from the proposed plants, coal mine runoff, and other activities associated with the development of coal.

Vegetation, Livestock Grazing, and Livestock Improvements

Short term loss of vegetation (and, therefore, forage for livestock and wildlife) would occur over the life of each mine (20 to 40 years).

All lands affected by coal mining would be legally required, after mining, to be returned to their approximate original contour and vegetative productivity. Revegetation effort on coal mines in similar areas indicate that mined lands in the EIS Region can be successfully revegetated with proper selection or conditioning of soils and irrigation. However, it should be noted that no lands have been through a full revegetation cycle and returned to grazing use.

Other areas for livestock grazing would need to be found for Navajo families who would lose their grazing areas while mining is being conducted and until reclamation takes place.

Temporary loss of any grazing areas would be a significant impact unless another area is found or unless the family is reimbursed for the loss. The full impacts of this situation are hard to predict at this time.

The Bypass Alternative would have the least amount of impact, while the impacts would increase tremendously under the MSOC Alternative. The loss of vegetation acreage nearly doubles from the MSOC to the Target Alternative and then again to the High Alternative, but the increase in loss of forage (AUM's) is only moderate. The Target and High Alternatives also encompasses the known habitat of state-sensitive species Astragalus wingatus.

Wildlife

Mining would result in the disturbance and destruction of wildlife numbers and habitat. The impacts would become more serious as more coal is mined, more habitat is destroyed, and human activity increases in the EIS Region. Comparing the alternatives, the estimated acreages that would be removed from wildlife utilization during the mine life shows substantial increases. Disturbances could occur on 200 to 300 acre of mule deer and elk winter range. While a species of high federal interest (ferruginous hawk), prairie falcon, and a golden eagle, and their possible nesting areas, would be impacted by surface mining, no new destruction to these species would occur under the MSOC Alternative.

Cultural Resources

The types of cultural resource impacts caused by mining are identified as possible destruction of uninventoried archaeological sites, vandalism and collection of artifacts due to ease of access into the EIS Region, and possible destruction of portions of the Chacoan roadway system. Each alternative shows an increse in the number of sites destroyed or disturbed by mining.

Site excavation and other forms of data recovery before mining would result in increased knowledge about past cultures in the EIS Region. However, some sites may have regionally sigificant values that require special attention in order to preserve important scientific information. Currently completed cultural surveys have not shown the existence of any cultural resources requiring protection in situ. If such resources are found, provisions in the lease stipulations will allow for these sites to be preserved inplace. While the Chaco Culture National Historical Park is nearby, mining would not occur in the park itself nor would mining directly adversely affect structures in the park. Studies are being conducted to determine the affects of blasting within the Park and should be completed prior to the final EIS.

Visual Resources

Mining, construction and use of related facilities would result in reductions in scenic values. The number of acres disturbed, and thus the impacts on scenic values, would increase under each alternative. Another impact would occur to the Continental Divide National Scenic Trail corridor. In the Bypass, Target and High Alternatives impacts would occur to a significant number of acres in the Bisti Badland. No impacts would occur to the Bisti Badlands under the MSOC Alternative.

Wilderness

Mining and associated activities would detract from the visual quality of the EIS Region. Noise would also be disturbing, especially when individuals hope to find a quality wilderness experience.

Recreation

Impacts on recreational activities would include pressures from an increse in population and the extraction of land from recreation use by mining operations. Mining activity would be very visually distracting, and noise pollution would have a detrimental effect on the recreation experience. The impacts to recreation would be commensurate with the level of mining under each of the four alternatives.

Land Uses

Land use impacts would involve the removal or relocation of transmission lines, pipelines, powerlines, roads, and railroads. A tremendous increase in the acreages of right-of-ways affected would occur between the Bypass and the Target Alternatives. Acreage affected would more than double between the Target and the High Alternatives.

Transportation

The impacts on transportation involve increases in the number of accidents, the amount of daily traffic, the demand for new road construction and road maintenance, and the potential for conflicting uses between mining operations, facilities developement, and the general public.

The alternatives show that the increase in the number of accidents would be minimal under the Bypass and the MSOC Alternatives. However, more than 36 additional accidents would occur under the Target Alternative and that number would double under the High Alternative. The Average Daily Traffic .(ADT) increases in the year 2000 show a large increase between the Bypass and the Minimum Surface Owner Conflict Alternative while the other alternatives show only a slight ADT increase.

Social and Economic Factors

If full development occurs under the No Action Alternative, it could displace use by Navajo faimilies of the EIS Region for livestock grazing. Because coal mining has the potential to foster other industrial development,

the possibility exists for a permanent change in the EIS Region from a rural setting to a semi-industrial setting, significantly affecting the off-reservation Navajo lifestyles.

Population would increase in proportion to the levels of coal development, as would available jobs, and the need for infrastructures and community expansion. Other problems associated with large influxes and sharp increases in population would dramatically increase with higher levels of coal development. This would largely affect the small communities in the EIS Region. Farmington has experienced much of this type of impact already due to the oil and gas industry, has adjusted to these changes, and would only be slightly affected by new federal coal leasing.

American Indian Concerns

Residences

One of the major issues for this EIS is the relocation of the American Indian families occupying the PRLA Area and adjacent competitive tracts; the social implications involved in relocating these people of traditional life styles are of concern. Every alternative would affect a certain number of known Navajo occupants, the largest increase occurring between the Target and High Alternatives.

Gravesites

In keeping with the Navajo tradition, the belief in witchcraft occuring as a result of the disturbance of gravesites during surface mining could have an effect on Navajo health and behavior. Under each alternative, a number of known grave sites in surface mining areas could be disturbed if not identified and removed before mining. These impacts could, however, be decreased by the performance of certain traditional ceremonies.

Sacred Sites

American Indian sacred sites should be recognized before they are destroyed by mine facility construction. Mining operations could be a hindrance to religions practice through population increases, noise, vibration, and dust. Each alternative would affect a number of sacred sites, with the High Alternative affecting the largest site number. These impacts could be decreased through ceremonies conducted by local medicine men.

CHAPTER 2
AFFECTED ENVIRONMENT

CHAPTER 2

AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the resource components of the environment that would be impacted by the proposed mining of coal on 39 competitive coal lease tracts in the San Juan River Region (also called the "EIS Region"). Also described are air quality, land uses, and American Indian concerns for the 26 Preference Right Lease Applications (PRLAs) considered as part of the No Action Alternative. (The description of the other resource components on the PRLAs can be found in Chapter 2 of the Final Environmental Assessment for Coal Preference Right Leasing, New Mexico--USDI, BLM 1981a.) The level of detail in the descriptions corresponds with the expected magnitude and intensity of the impacts discussed in Chapter 3. Technical material supporting these descriptions and the analysis in Chapter 3 is located in the Appendix of this document, or is on file and available for public review at the BLM Farmington Resource Area Office.

CLIMATE

The major portion of the San Juan River Region is characterized by generally clear, sunny skies and a semi-arid climate. The general elevation of the EIS Region is about 5,000 feet, with a significant portion greater than 7,000 feet. The high elevation and generally clean dry air combine to give large daily temperature fluctuations. The average maximum temperatures vary from 67 to 88 degrees Fahrenheit, with average minimum temperatures between 35 and 65 degrees. Daytime summer temperatures above 100 degrees are coupled with near-freezing temperatures at night. The average number of frost-free days is 140, with a range of less than 100 to more than 160, depending on location.

The annual precipitation varies between 10 and 14 inches; however, due to evapotranspiration losses, an annual moisture deficit of 10 to 12 inches occurs. During the growing season, the average precipitation varies from 4 inches in the northwest portion of the EIS Region to over 6 inches in the southwest portion. The extremes for growing season precipitation are 4 and 15 inches. These variations occur both geographically and yearly, and they result from differences in elevation and topography.

These latter differences cause variations in the prevailing wind direction and speed. Winds in the Gallup vicinity are predominantly from the southwest, while the winds measured in Farmington come from the east-northeast and the west.

In general, the lack of moisture in the EIS Region makes reclamation more difficult than in other parts of the country.

AIR QUALITY

The Environmental Protection Agency (EPA) has divided the country into Air Quality Control Regions (AQCR). The EIS Region lies mostly within the Four Corners Air Quality Control Region 14. New Mexico has designated this AQCR as State Region Number 1. A small portion of the EIS Region, in the vicinity of the Chaco Wash and Lee Ranch tracts, is in AQCR 156 or State Region Number 8.

All AQCRs are classified either as "attainment areas" (they meet the national ambient air quality standards) or as "non-attainment areas" (they exceed the standards). Both of the AQCRs overlapping the EIS Region (14 and 156) are classified as attainment areas for total suspended particulates (TSP).

The background level of TSP is considered to be 30 micrograms per cubic meter (ug/m^3). The annual primary federal standard is 75 ug/m^3 maximum, and the annual New Mexico state standard is 60 ug/m^3. The 24-hour New Mexico state standard is 150 ug/m^3. None of these standards are normally exceeded in the EIS Region, making the AQCRs attainment areas for TSP.

Particulate matter (TSP) is usually the only pollutant generated in large enough quantities by surface mines to have a significant impact on regional air quality. Other pollutants such as nitric oxide (NO) and sulfur dioxide (SO^2) are not considered problems in areas of coal mining.

All pollutant sources in attainment areas must be evaluated to determine their level on the Prevention of Significant Deterioration (PSD) scale. Coal mines are subject to new source review by the Environmental Protection Agency or the State of New Mexico for PSD levels only if their emissions of any regulated pollutant would exceed 250 tons per year after application of controls. Surface coal mines seldom exceed that level, which would eliminate the proposed lease tracts from a detailed PSD review. However, though the tracts are not subject to this PSD review, fugitive emissions (in this case, TSP) are tracked in this EIS.

Under the PSD regulations, the San Pedro Parks Wilderness Area (managed by the U.S. Forest Service), and the Mesa Verde National Park are designated as Class I areas for air quality. (Class I areas have stringent limits on increased concentrations of sulfur dioxide and TSP, and are also given protection from visibility degradation.) Because of the distance of these Class I areas from the EIS Region and the relatively short distance TSP will travel from mining operations (generally less than 20 kilometers), these areas are considered to be outside of the EIS Region.

Under natural conditions, the EIS Region is subject to periods of blowing dust. The amount of dust in the air is dependent on several factors, such as wind speed and moisture content of the soil. These periods of blowing dust reduce visibility for the duration of the dust storms, and at times the ambient TSP standards are exceeded due to these natural conditions. Very limited data exists on the visibility in the EIS Region, and most of it is based on measurements taken at the Chaco Culture National Historical Park. This data shows the visual range to average about 127 miles. Ninety percent of the time the visual range is 160 miles or less, and 10 percent of the time it is 85 miles or less.

The EIS Region experiences air inversions nearly 70 percent of the time. However, these inversions usually are dispersed by daytime surface heating. The region generally experiences a deep air mixing level, which disperses pollutants.

TOPOGRAPHY AND GEOLOGIC HAZARDS

Topography

The San Juan River Region lies within the San Juan topographic and structural basin. The central part of the basin is a dissected plateau, the surface of which slopes gently west, and is characterized by low mesas, buttes and broad cuestas. The Bisti Badlands (barren, colorful shale hills and gulleys) are notable. The Continental Divide wanders through the EIS Region in a northeast to northerly direction and is generally expressed as a subdued ridge, little more prominent than many other ridges or nearby mesas. The principal streams have cut into the semi-arid plateau to form steep-walled canyons.

Geologic Hazards

Ground subsidence has occurred as a result of underground mining in the Ambrosia Lake Uranium District, an area 5 to 6 miles south of the Lee Ranch tracts (refer to Visual C for the location of these tracts). Additional collapse over old mine workings is possible in this district. Subsidence from natural causes is known around "pipes" in the shale in badland areas of the Fruitland and Kirtland Formations. The uneven erosion of the alternating sandstone and shales of Cretaceous age presents opportunity for slope failures and rockfalls.

MINERAL RESOURCES

Coal Stratigraphy

The individual coal beds in the San Juan River Region are highly lenticular (refer to the Glossary) and their mineable thickness rarely extends for more than 6 miles. Thus a complete discussion of individual coal seams would include hundreds of named, numbered, lettered, and unlabeled coal beds. Description of coals in the EIS Region, therefore, is done by referring to the coal-bearing members of formations in an individual field or area. The designation of the coal fields/areas in the San Juan Basin has been somewhat arbitrary, with most of the boundaries drawn at formational contacts and others on township lines.

Coal deposits are present in the San Juan Basin in the Crevasse Canyon Formation, the Mesa Verde Group, and the Fruitland Formation. The Crevasse Canyon Formation contains two coal-bearing units, the Dilco Member and the Gibson Member (Figure 2-1). These units occur only in the southern portion of the EIS Region, as shown on Figure 2-2. Two coal-bearing units in the Mesa Verde Group are located in the lower and upper few hundred feet of the Menefee Formation; these are informally called the "lower coal member" and "upper coal member" (Figure 2-1 and Map 2-1) throughout most of the basin. The Menefee Formation crops out mainly in the southern part of the EIS Region, as shown on Map 2-1.

The Fruitland Formation is the stratigraphically highest of the Upper Cretaceous coal-bearing units of the San Juan Basin. Although coal occurs throughout the Fruitland, the thickest beds are concentrated in its lowermost third. The formation crops out principally in the central part of the EIS Region, as shown on Map 2-1.

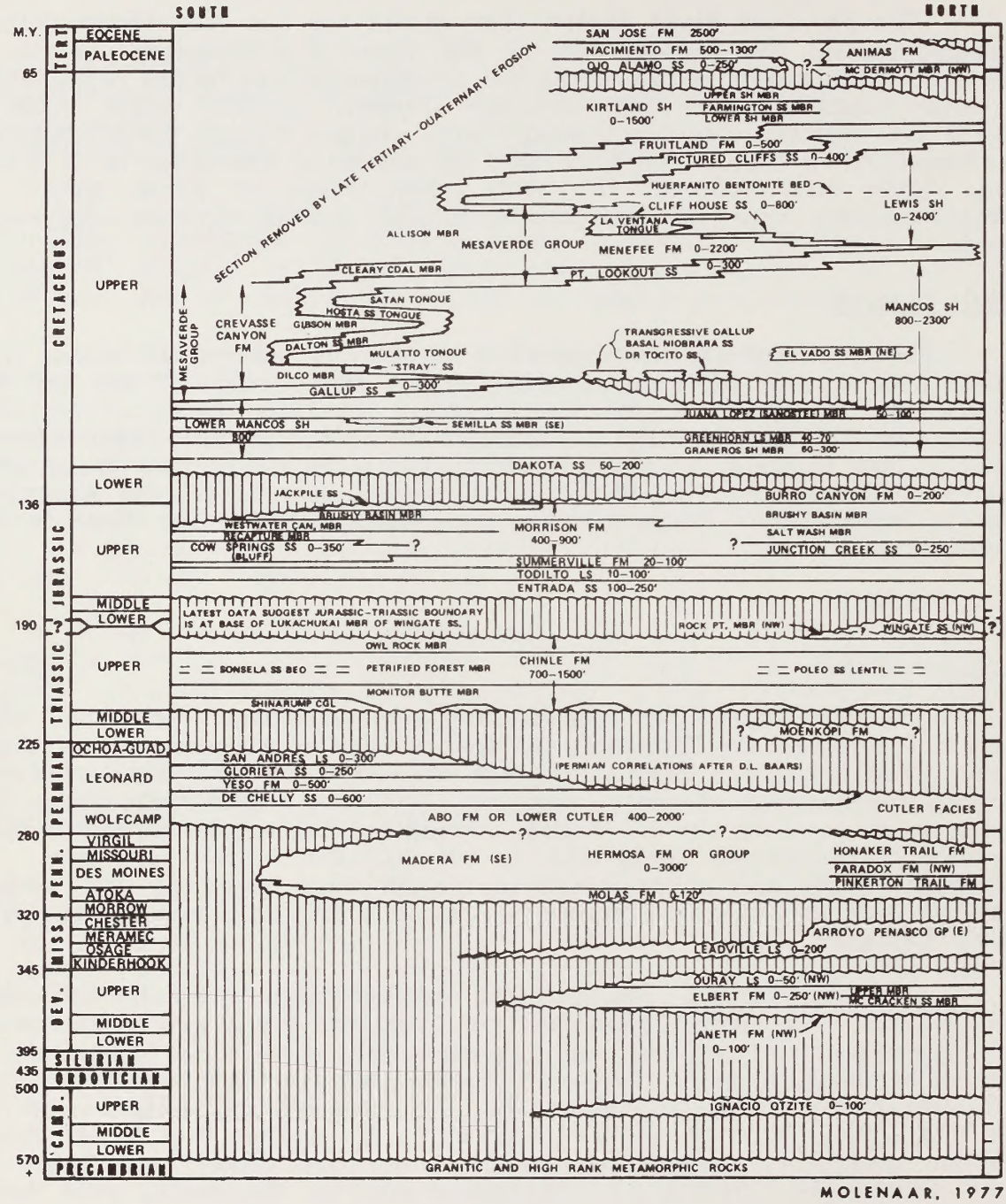


Figure 2-1

SAN JUAN BASIN TIME-STRATIGRAPHIC NOMENCLATURE CHART

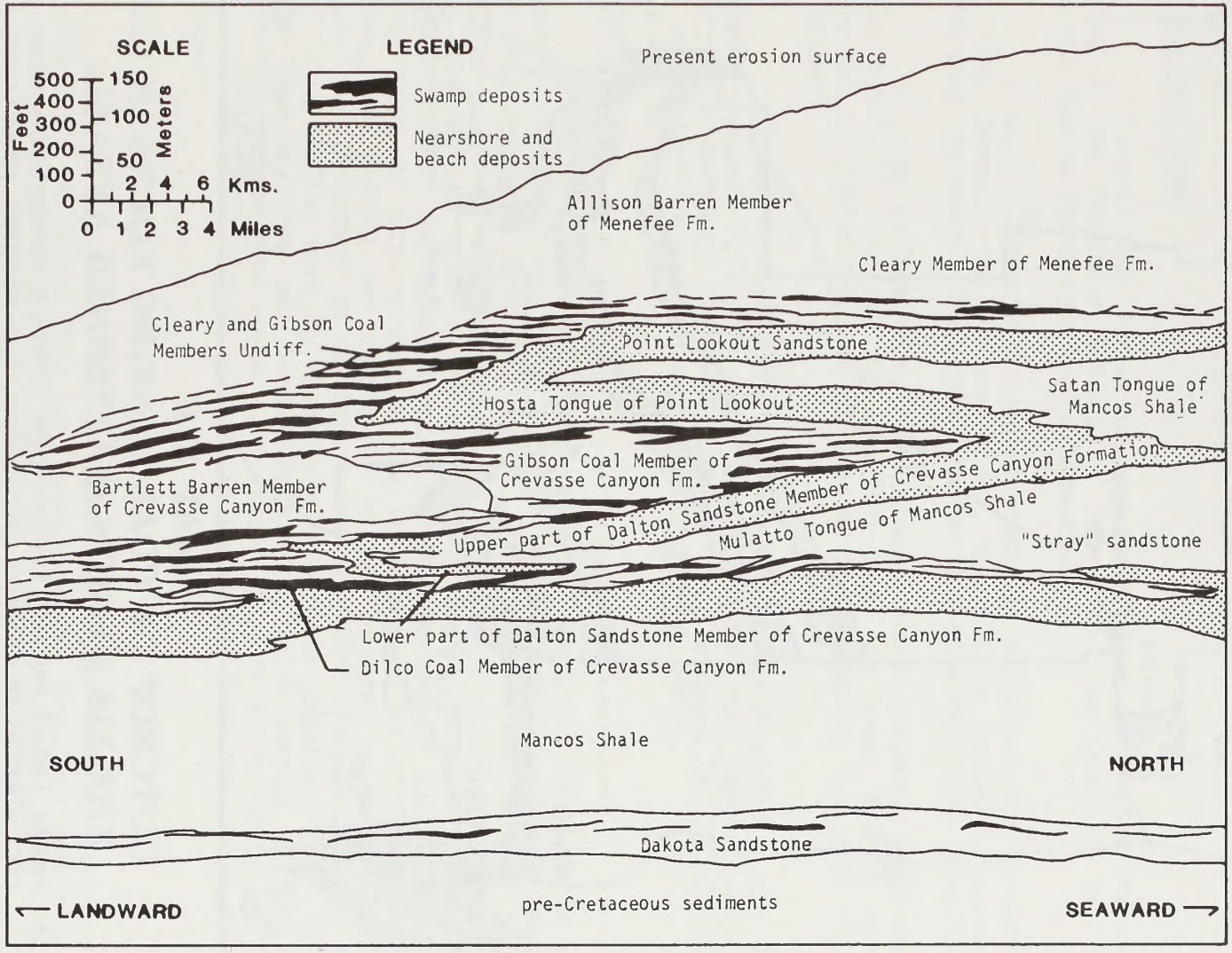
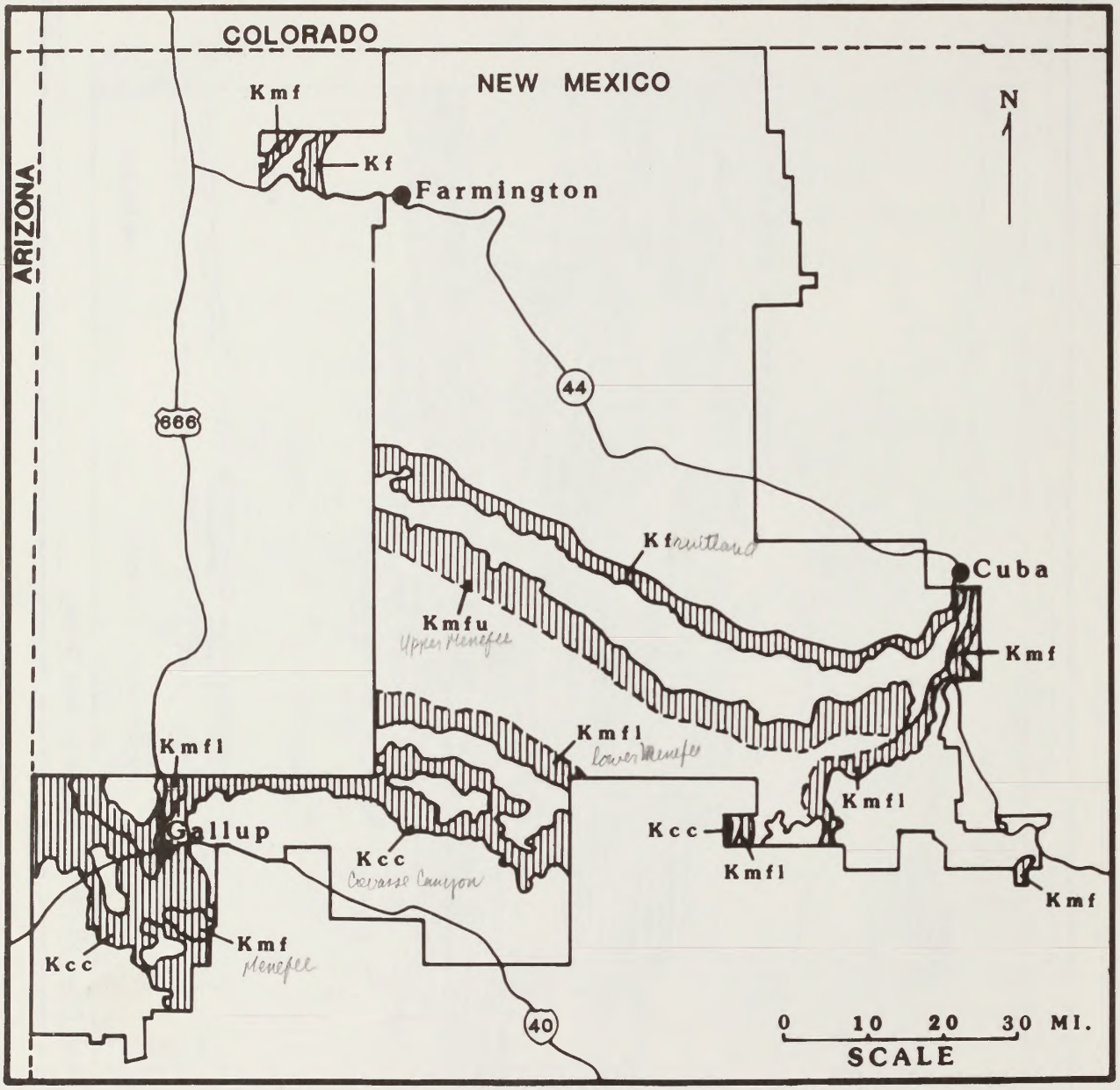


Figure 2-2. Generalized Cross Section of Coal Beds Near Gallup



MAP 2-1
OUTCROP OF COAL-BEARING ROCKS IN THE EIS REGION (PATTERNED AREAS)

NOTE: THESE AREAS DO NOT EVERYWHERE CONTAIN COMMERCIAL COAL. (KCC-CREVASSE CANYON FORMATION, KMF-MENEFEE FORMATION, KMFL-LOWER COAL-BEARING MEMBER OF MENEFEE FORMATION, KMFU -UPPER COAL-BEARING MEMBER OF MENEFEE FORMATION, KF-FRUITLAND FORMATION.)

In a relative sense, coal beds of the Crevasse Canyon and the Menefee Formations are much thinner and more discontinuous than the coal beds of the Fruitland Formation. Fruitland coal beds are commonly 10 to 20 feet thick and occasionally attain a thickness of up to 40 feet. Crevasse Canyon and Menefee coals rarely reach 10 feet in thickness and more often are on the order of 6 feet or less.

Operating Coal Mines

Several coal mines and mine-mouth power generating stations are operating in the Fruitland Formation. Nearly all the mines in the Crevasse Canyon and Menefee Formations are now abandoned.

A small surface mine located southeast of Gallup, the Yellowhorse or Amcoal Mine (formerly the Sundance Mine), has been in production sporadically over the past few years. The production for this mine was 94,000 tons in 1981.

A large surface mine, the Pittsburg-Midway Company's McKinley Mine, produced 4,568,154 tons of coal in 1981 from the lower Menefee and upper Crevasse Canyon Formations. It is located in New Mexico just east of Window Rock, Arizona.

In addition, in 1981 the Navajo and San Juan Mines just west of Farmington produced 7,733,000 tons and 4,538,000 tons respectively. The De-na-zin Mine southeast of the village of Bisti produced 13,177 tons in 1981. All of these mines are surface operations (Martinez, 1981).

Coal Quantity

With only a few exceptions, where the Fruitland Formation is present it contains commercial coal beds. The Fruitland Formation contains by far the largest coal resources of the EIS Region. Fassett and Hinds (1971, p.68) state: "...it was determined that approximately 6,250 square miles within the area of the San Juan Basin is underlain by coal beds of the Fruitland Formation and that the beds contain an aggregate of about 200 billion tons of coal. Owing to the regional nature of this study and the methods used in estimating the coal resources, the results are considered to be 'inferred by zone' rather than 'measured' or 'indicated' as defined by Averitt (1961)." Of this 200 billion tons, 7 to 10 billion tons may ultimately be surface mineable. This contrasts with the Crevasse Canyon and Menefee Formations, which contain commercial coal deposits only in scattered areas. The reader is referred to Tables 2-1 through 2-4 for the projected amounts of coal in the competitive coal lease tracts by alternative.

Coal Quality

Heating values for the Crevasse Canyon and Menefee Formation coals range from 8,000 to 12,000 BTus per pound, whereas Fruitland Formation coals have a slightly lower range. In general, Fruitland coals have a higher ash content than the Crevasse Canyon and Menefee coals. Sulfur content for all the coals of the EIS Region is low, ranging from 0.5 percent to 1.5 percent, and averaging around 0.6 to 0.7 percent. The Mesa Verde Group coals range in rank from subbituminous B to high-volatile bituminous B (refer to the Glossary for a discussion of rank) with coals in the upper part of the basin being generally of higher rank. The Fruitland Formation coals range from subbituminous A to

TABLE 2-1

COAL RESOURCES,
BYPASS ALTERNATIVE
(millions of tons)

Tract	Reserve			Recoverable		
	Federal	Non-Federal	Total	Federal	Non-Federal	Total
La Plata #1	9.0	---	9.0	8.0	---	8.0
Star Lake West #2	28.0	---	28.0	24.0	---	24.0
Kimbeto #2	20.0	---	20.0	18.0	---	18.0
Gallo Wash #1	11.0	---	11.0	10.0	---	10.0
Bisti #6/8	1.0	---	1.0	1.0	---	1.0
Hospah #1	22.0	196.0	218.0	19.0	167.0	186.0
Gamerco #1 (HC)	3.0	1.0	4.0	3.0	1.0	4.0
Bisti #4	35.0	1.0	36.0	30.0	1.0	31.0
TOTALS	129.0	198.0	327.0	113.0	169.0	282.0

Source: Developed from USDI, MMS Tract Delineation Reports, 1982.

TABLE 2-2

COAL RESOURCES,
MINIMUM SURFACE OWNER CONFLICTS ALTERNATIVE
(millions of tons)

Tract	Reserve			Recoverable		
	Federal	Non-Federal	Total	Federal	Non-Federal	Total
La Plata #1	9.0	---	9.0	8.0	---	8.0
La Plata #2 a/	12.0	---	12.0	2.0	---	2.0
Kimbeto #1 a/	145.0	13.0	158.0	38.0	3.0	41.0
Kimbeto #2	20.0	---	20.0	18.0	---	18.0
Nageezi	466.0	121.0	587.0	83.0	26.0	109.0
Gallo Wash #2 a/	35.0	40.0	75.0	9.0	10.0	19.0
Lee Ranch East	16.0	22.0	38.0	14.0	19.0	34.0
Lee Ranch Middle	86.0	154.0	240.0	73.0	131.0	204.0
Lee Ranch West	101.0	137.0	138.0	86.0	116.0	202.0
Divide	16.0	27.0	43.0	14.0	23.0	37.0
Hospah #2 a/	10.0	49.0	59.0	5.0	25.0	30.0
TOTALS	916.0	563.0	1,480.0	349.0	353.0	702.0

Source: Developed from USDI, MMS Tract Delineation Reports, 1982.

Note: a/ Underground tract

TABLE 2-3

COAL RESOURCES,
TARGET ALTERNATIVE
(millions of tons)

Tract	Reserve			Recoverable		
	Federal	Non-Federal	Total	Federal	Non-Federal	Total
La Plata #1	9.0	—	9.0	8.0	—	8.0
La Plata #2 a/	12.0	—	12.0	2.0	—	2.0
Star Lake West #2	28.0	—	28.0	24.0	—	24.0
Kimbeto #1 a/	145.0	13.0	158.0	38.0	3.0	41.0
Kimbeto #2	20.0	—	20.0	18.0	—	18.0
Nageezi a/	466.0	121.0	587.0	83.0	26.0	109.0
Gallo Wash #1	11.0	—	11.0	10.0	—	10.0
Gallo Wash #2 a/	35.0	40.0	75.0	9.0	10.0	19.0
Bisti #6/8	1.0	—	1.0	1.0	—	1.0
Lee Ranch East	16.0	22.0	38.0	14.0	19.0	33.0
Lee Ranch Middle	86.0	154.0	240.0	73.0	131.0	204.0
Lee Ranch West	101.0	137.0	238.0	86.0	116.0	202.0
Divide	16.0	27.0	43.0	14.0	23.0	37.0
Hospah #1	22.0	196.0	218.0	19.0	167.0	186.0
Hospah #2 a/	10.0	49.0	59.0	5.0	25.0	30.0
Gamerco #1 (HC)	3.0	1.0	4.0	3.0	1.0	4.0
Bisti #4	35.0	1.0	36.0	30.0	1.0	31.0
Johnson Trading Post	17.0	2.0	19.0	14.0	2.0	16.0
Star Lake East #1	61.0	6.0	67.0	52.0	5.0	57.0
Bisti #1	150.0	—	150.0	127.0	—	127.0
Bisti #2	64.0	—	64.0	54.0	—	54.0
Catalpa Canyon	0.4	8.0	8.4	.34	7.0	7.34
Sundance	4.0	1.5	5.0	3.0	1.0	4.0
Samson Lake #2/2	11.0	28.0	39.0	9.0	.37	9.37
TOTALS	1,320.4	806.5	2,100.4	696.34	538.37	1,200.7

Source: USDI, MMS Tract Delineation Reports, 1982.

Note: a/ Underground tracts

TABLE 2-4

COAL RESOURCES
HIGH ALTERNATIVE
(millions of tons)

Tract	Reserve			Recoverable		
	Federal	Non-Federal	Total	Federal	Non-Federal	Total
La Plata #1	9.0	---	9.0	8.0	---	8.0
La Plata #2 a/	12.0	---	12.0	2.0	---	2.0
Star Lake West #2	28.0	---	28.0	24.0	---	24.0
Kimbeto #1 a/	145.0	13.0	158.0	38.0	3.0	41.0
Kimbeto #2	20.0	---	20.0	18.0	---	18.0
Nageezi a/	466.0	121.0	587.0	83.0	26.0	109.0
Gallo Wash #1	11.0	---	11.0	10.0	---	10.0
Gallo Wash #2 a/	35.0	40.0	75.0	9.0	10.0	19.0
Bisti #6/8	1.0	---	1.0	1.0	---	1.0
Lee Ranch East	16.0	22.0	38.0	14.0	19.0	33.0
Lee Ranch Middle	86.0	154.0	240.0	73.0	131.0	204.0
Lee Ranch West	101.0	137.0	238.0	86.0	116.0	202.0
Divide	16.0	27.0	43.0	14.0	23.0	37.0
Hospah #1	22.0	196.0	218.0	19.0	167.0	186.0
Hospah #2 a/	10.0	49.0	59.0	5.0	25.0	30.0
Gamerco #1 (HC)	3.0	1.0	4.0	3.0	1.0	4.0
Bisti #4	36.0	1.0	37.0	30.0	1.0	31.0
Johnson Trading Post	17.0	2.0	19.0	14.0	2.0	16.0
Star Lake East #1	61.0	6.0	67.0	52.0	5.0	57.0
Bisti #1	150.0	---	150.0	127.0	---	127.0
Bisti #2	64.0	---	64.0	54.0	---	54.0
Catalpa Canyon	0.4	8.0	8.5	.34	7.0	7.34
Sundance	4.0	1.0	5.0	3.0	1.0	4.0
Samson Lake #2/2	11.0	28.0	39.0	9.0	.37	9.37
La Plata #3	2.0	3.0	5.0	2.0	2.0	4.0
La Plata #4 a/	20.0	---	20.0	10.0	---	10.0
Star Lake East LCa	64.0	---	64.0	21.0	---	21.0
Crownpoint NE	150.0	---	150.0	94.0	---	94.0
Crownpoint East (HC/LC)	149.0	129.0	278.0	124.0	5.0	129.0
Chico Wash South	74.0	6.0	80.0	63.0	8.0	71.0
Tah-ha-bah Well a/	23.0	---	23.0	12.0	---	12.0
Hogback	5.0	---	5.0	4.0	---	4.0
Twin Buttes	68.0	---	68.0	30.0	---	30.0
Pinehaven Bread	7.0	---	7.0	6.0	---	6.0
Springs #1 Bread	1.0	1.0	2.0	1.0	1.0	2.0
Springs #2 a/	10.0	2.0	12.0	5.0	2.0	7.0
Gamerco #1 (LC)	2.0	1.0	3.0	3.0	1.0	4.0
Gamerco #2 LC) a/	17.0	19.0	36.0	8.0	9.0	17.0
Samson Lake #1 a/	27.0	8.0	35.0	13.0	---	13.0
TOTALS	1,940.4	975.0	2,920.5	1,090.34	565.37	1,650

Source: USDI, MMS Tract Delineation Reports, 1982.

Note: a/ Underground tracts

high-volatile bituminous C, with the northern Fruitland coals generally somewhat higher in rank.

PALEONTOLOGY

For convenience in discussion of this resource, the EIS Region is divided into two parts: the Southern Area, which contains rocks from the Triassic to the Upper Cretaceous period, and the Northern Area, which contains rocks from the Upper Cretaceous to the Cretaceous-Tertiary period boundary. Table 2-5 shows the separation of the proposed leasing tracts into these two areas. The general stratigraphic succession and fossils are illustrated in Figure 2-3.

Southern Area

The stratigraphy of the Dakota-Mancos transition is reviewed by Dane et al. (1971), and Hook and Cobban (1979). Several units of the Mancos Shale are quite fossiliferous, yielding a diverse fauna of molluscs. The paleontology of these units is reviewed by Cobban (1977a). Additional discussion of the paleontology of the Dakota-Mancos transition can be found in Cobban (1977b), Landis et al. (1973), and Hook and Cobban (1977).

The Mancos is the thickest of the units exposed in the Southern Area, with a thickness of up to 2,300 feet in the eastern portions of the Southern Area. Thus, while the unit yields a diverse fauna, its density is relatively low. Fossils tend to be concentrated in particular horizons, such as concretions and siltstone interbeds. It is clear from the faunal lists derived from literature sources that intensive collecting from various horizons within the Mancos would result in a diverse and biostratigraphically valuable collection.

The Mesa Verde Group is subdivided into the following stratigraphic units (in ascending order): Gallup Sandstone, Crevasse Canyon Formation, Point Lookout Sandstone, and Menefee Formation. The Gallup Sandstone is a potentially significant fossiliferous unit that deserves more detailed study. A list of fossils reported from the Gallup Sandstone is reviewed in Flessa (1981). Most outcrops of this sandstone, while they may yield fossils, are not likely to produce collections significant enough for the complete protection of the exposure.

Fossils in the Crevasse Canyon Formation are rare and unstudied. Of the previously discovered localities within the Crevasse Canyon of the Southern Area (listed in Flessa 1981), only one is noteworthy. This site contains the first vertebrate material to be precisely noted from the Crevasse Canyon. The presence of coal units within the Crevasse Canyon and the known presence of plant fossils suggests that a concentrated paleobotanical survey would be likely to yield important plant fossils.

Little detailed stratigraphic and no detailed paleontological work on the Menefee Formation have been done within the Southern Area. In areas previously studied, plant fragments are the most commonly reported fossil material. An evaluation of the potential paleontological significance of the Menefee is extremely difficult because so little is known about it. A previous survey (Kues et al., 1977) suggests that the Menefee may yield significant paleobotanical material upon close inspection.

TABLE 2-5

SEPARATION OF PROPOSED COAL LEASING TRACTS INTO AREAS FOR PALEONTOLOGY ANALYSIS

Northern Area	
La Plata #1	Bisti #4
La Plata #2	Johnson Trading Post
Star Lake East #2	Star Lake East #1
Kimbeto #1	Bisti #1
Kimbeto #2	Bisti #2
Nageezi	La Plata #3
Gallo Wash #1	La Plata #4
Gallo Wash #2	Star Lake East (LC)
Bisti #6/8	

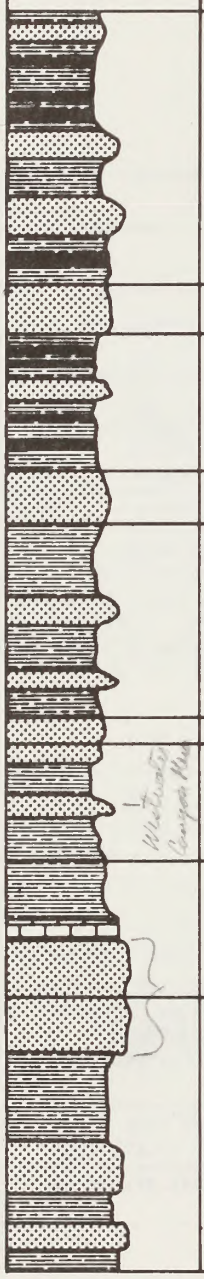
Southern Area	
Lee Ranch East	Crownpoint East (HC/LC)
Lee Ranch Middle	Chico Wash South
Lee Ranch West	Tah-ha-bah Well
Divide	Hogback
Hospah #1	Twin Buttes
Hospah #2	Pinehaven
Gamerco #1 (HC)	Bread Springs #1 and #2
Catalpa Canyon	Gamerco #1 (LC)
Sundance	Gamerco #2
Samson Lake #2/2	Samson Lake #1
Crownpoint Northeast	

Figure 2-3. General Stratigraphic Section

Lithology	Rock-Strat. Units	Age	Fossils
	Alluvium	Quaternary	None reported
	Zia Sand	Miocene	Fossil mammals, principally rodents.
	Upper part of Galisteo Formation	Late Eocene	Some petrified wood and fossil mammals, mostly titanotheres.
	San Jose Formation	Early Eocene	Diverse vertebrate faunas of primitive mammals, turtles, crocodiles, fish, lizards, snakes, and a bird. Some fresh water gastropods and unionids. Rare fossil leaves and some petrified wood.
	Nacimiento Formation	Early to Middle Paleocene	Diverse vertebrate faunas of mammals, etc. Some fresh water invertebrates, wood and leaves.
	Ojo Alamo Sandstone	Earliest Paleocene	Rare fossil mammals. Much petrified wood.
	Kirtland Shale	Late Cretaceous	Dinosaurs, turtles, crocodiles, and other vertebrates. Leaves and wood locally abundant. Some fresh water invertebrates.
	Fruitland Formation	Late Cretaceous	Similar to Kirtland some brackish water inverts much fossil wood.
	Pictured Cliffs Sandstone	Late Cretaceous	Marine invertebrates and trace fossils.
	Lewis Shale	Late Cretaceous	Bivalves, ammonites, and other marine invertebrates, one mosasaur.
	Cliff House Sandstone	Late Cretaceous	Marine invertebrates and trace fossils, sharks teeth.

(continued on next page)

(Figure 2-3 continued)



Rock-Strat. Units	Age	Fossils
Menefee Formation	Late Cretaceous	Fossil leaves and wood common. Rare vertebrates (mostly shark teeth and turtle scrap) and invertebrates.
Point Lookout Sandstone	Late Cretaceous	Marine invertebrate and trace fossils.
Crevasse Canyon Formation	Cretaceous	Some fossil leaves and wood. Rare lower vertebrate and invertebrate fossils.
Gallup Sandstone	Cretaceous	Marine inverts some fossil leaves
Mancos Shale	Cretaceous	Great Diversity of marine invertebrates, especially ammonites and bivalves.
Dakota Sandstone	Lwr (?) Cret.	Marine inverts, plants
Morrison Formation	Late Jurassic	Some dinosaurs and petrified wood
San Rafael Group	Jurassic	Brackish water invertebrates. Fish in Todilto Limestone, and rare fossil plants.
Entrada ? Chinle Formation	Late Jurassic	Plant and lower vertebrate fossils locally abundant.

Generalized composite section showing formations that crop out in the EIS Region. Fossils listed are those reported from the literature sources pertaining to areas both within and adjacent to the EIS Region. There are regional variations in thickness and facies.

KEY

SANDSTONE
CONGLOMERATE
REDBEDS
SHALE
COAL
LIMESTONE
ALLUVIUM & BASALT
UNCONFORMITY

Scale: | = 300 feet

Northern Area

Late Cretaceous formations in this area fall into three general environments: off-shore marine deposits (mainly shale, minor sandstones and limestones); regressive and transgressive shoreline deposits (usually sandstones); and continental sediments (generally shales and sandstones representing stream or swamp environments and containing more organic material, notably coal). By far the largest part of the Northern Area contains exposures of the Late Cretaceous Kirtland/Fruitland Formation. Its off-shore marine and shoreline deposits all contain marine invertebrate faunas of varying diversity, mostly molluscan. Other discussion can be found in the BLM's Chaco-San Juan Planning Unit Resource Analysis -- Update for Coal (USDI, BLM 1980b). A review of the flora and fauna of the Late Cretaceous is given in Kues et al. (1977), and Lucas, Rigby and Kues, eds. (1981).

The Kirtland/Fruitland Formation has received special attention because of its vertebrate faunas. This formation and the Nacimiento contain an almost unparalled record of one of the most important episodes in the history of life -- the abrupt change from domination of terrestrial communities by dinosaurs to domination by mammals.

SOILS

Soils for the 39 tracts are represented by 3 groups and 13 associations, with small occurrences of other soils (refer to Table 2-6). These soils are derived from alluvial, eolian, and residuum sandstone and shale. They are found on uplands, mesas, benches, hillsides, fans, valley sideslopes, and valley bottoms. Soil textures are represented by sands, loams, and clays. Soil depths run from shallow (±15 inches) to deep (+40 inches), and soil colors range from browns to grays. Permeability is slow to rapid, with runoff high to low. Some of the soil associations have inclusions of soils with gravelly substrata, alkali-affected areas, rocklands, and badlands.

Soil data for the 39 tracts was taken from the Soil Survey of San Juan County, New Mexico, Eastern Part (USDA, SCS BIA, BR and NM Agricultural Experiment Station 1980) and the Chaco-San Juan Planning Unit Resource Analysis--Update for Coal (USDI, BLM 1980b).

RECLAMATION POTENTIAL

Reclamation potential is high for underground mines and low to moderate for surface mines in the EIS Region. Reclamation may be limited for some of the tracts because of soil characteristics found within certain land types. The amount of these soil types and their limitations for reclamation will not be fully known until soil surveys are conducted on the competitive coal lease tracts and reclamation plans submitted and implemented by companies.

However, it is possible that reclamation can be enhanced on the land types (discussion follows) to a moderate level (or, in some instances, better) if soil characteristics and textures are changed or altered to produce more favorable conditions for plant revegetation. Deep, coarse-textured soils can be mixed with fine-textured soils to create a better matrix for plant regrowth. Sandstone outcrops found in badland areas can be ground up, then mixed or layered with the unproductive soils to produce a better situation for revegetation. In active dune areas, sandy soils can be added to saline-sodic soils to change the salt/sodium exchange levels through mixing and layering.

TABLE 2-6

SOILS INTERPRETATION SUMMARY

	Soil Association	Depth (Inches)	Runoff Rate	Erosion/Hazard	Color	Permeability	Texture/Surface	Origin	Percent of Association
1.	Hagerman-Travessilla	12-40	Medium	Moderate-High	Browns	Moderate-Rapid	Fine sandy loam-silty clay loam	Residually weathered sandstone and shale	Hagerman (35%)-Travessilla (20%)
2.	Las Lucas-Litle-Persayo	10-60	Medium-Rapid	Moderate-High	Gray	Slow-Moderate	Loam-silty clay cloam	Shale bedrock or alluvium	Las Lucas (30%)-Litle (25%)-Persayo (25%)
3.	Shiprock-Sheppard Doak	40-60	Slow-Medium	Moderate-High	Browns	Moderate-Rapid	Fine sandy loam-loam	Alluvial & eolian sandstone & shale	Shiprock (28%)-Sheppard (23%)-Doak (23%)
4.	Blancot-Notal	60	Medium	Moderate-High	Browns	Slow-Moderate	Loam-silty clay loam	Sandstone & shale alluvium	Blancot (55%)-Notal (25%)
5.	Sheppard-Huerfano-Notal	15-60	Medium	Moderate	Browns	Moderate-Rapid	Loamy fine sand-silty clay loam	Eolian, alluvial, residuum sand stone, shale, & siltstone	Sheppard (25%)-Huerfano (13%)
6.	Badland-Rock Outcrop Monierco	±13	Medium-Rapid	Moderate-High	Brown-Grays	Slow-Rapid	Fine sandy loam-barren shale & sandstone	Eolian & alluvial material	Badlands (74%)-Rock Outcrop (15%)- Monierco (8%)
7.	Persayo-Lohmiller	10-60	Medium-Rapid	Moderate-High	Grays-Browns	Slow-Moderate	Fine sand-clay	Residual sandstone & shale, eolian sands & alluvial & sandstone	Persayo (35%-Lohmiller (30%)
8.	Penistaja-Sheppard Rockland	±60	Slow-Medium	Moderate-High	Browns	Moderate-Rapid	Loamy fine sand-clay loam	Eolian & alluvial shale stone & shale	Penistaja (35%)-Sheppard (20%)-Rockland (25%)
9.	Penistaja-Sheppard	±60	Slow-Medium	Moderate-High	Browns	Moderate-Rapid	Loamy sand-light clay loam	Eolian & alluvial sand-sandstone & shale	Penistaja (55%)-Sheppard (25%)
10.	Travessila-Persayo-Rockland	10-20	Medium-Rapid	Moderate-High	Browns-Grays	Slow-Moderate	Fine sandy loam-silty clay loam	Residually weathered sand & shale	Travessilla (30%)-Persayo (25%)-Rockland (25%)
11.	Penistaja-Sheppard-Palma	±60	Slow-Medium	Moderate-High	Browns	Moderate-Rapid	Loamy sand-light clay loam	Eolian & alluvial deposits & residuum sandstone & shale	Penistaja (35%)-Sheppard (20%)-Palma (20%)
12.	Thurloni-Savoia-Concho	20-60	Medium	Moderate	Browns-Grays	Moderate	Fine sand-clay	Eolian sands, alluvial	Thurloni (30%)-Savoia (20%)-Concho (12%)
13.	Penistaja-Lohmiller Travessila	10-60	Medium	Moderate	Browns	Moderate-Rapid	Fine sand-clay	Eolian sands, alluvial & residuum sandstone & shale	Penistaja (35%)-Lohmiller (30%)- Travessilla (25%)

Irrigation can also be used to supplement natural rainfall during critical growing periods and enhance revegetation potential on the tracts. Successful revegetation has occured in the region at the San Juan, McKinley, and Navajo Mines with the aid of irrigation.

Soils found within badland areas include Soil Association 1, 4, 6, and 8 through 13 on Table 2-6. These soils are shallow and poorly developed, and are considered to be unsuitable as a source of planting media by themselves. Sparse vegetation and barren areas are found on these soils, with natural fertility and organic matter very low. Soil textures are generally clays; restricted permeability, high salinity, severe erosion hazards, and excessive slopes are characteric. Rough topography and deep drainage channels can be found in these areas.

Soil Associations 1, 2, 4 and 6 through 13 (Table 2-6) are found within rockland areas. These soils are highly variable, having textures ranging from sands to sandy loams. They are generally shallow and poorly developed. Considered unsuitable as planting media, these soils have very low natural fertility and organic matter, and erosion potential from wind and water is high. The percentage of occurrence of rockland areas within the proposed lease tracts runs from 3 to 27 percent.

Some soils found in valley areas are considered unsuitable for planting media by themselves; organic matter and natural fertility is very low. (Refer to Soil Associations 6 through 9 and 11 through 13 in Table 2-6.) These are saline-sodic soils with scattered sparse vegetation and barren areas. Found on nearly level or very gently sloping areas, these soils have developed from streamflow deposits except for very shallow sandy windblown material in scattered areas. Textures usually range from loamy sand to clay. Permeability varies, but where a high amount of sodium occurs, moisture penetration is very restricted or eliminated. Sodium levels are sometimes high in both surface and sub-soils, ranging from 15 to 50 percent of the exchange capacity (refer to the Glossary).

Soils found within active dunes (Soil Associations 1, 3, 6 through 8, and 10 through 13 in Table 2-6) are considered unsuitable for planting media. These areas consist of undulating ridges and small hills. Soils are generally barren and subject to severe wind erosion, with a very low natural fertility level and an organic matter content of nearly zero. Textures are usually fine sand and sand. These soils have excessive permeability resulting in low water-holding capacity and little water availability for plant growth.

Soils found in stream and drainage channels (all soil associations in Table 2-6) are considered unsuitable for planting media by themselves. These soils are composed of deposits associated with major drainage systems. Natural fertility level is very low, and water-holding capacity is very poor. Textures are usually sandy with deposits of gravel and cobble. These soils are subject to severe wind erosion and are usually barren.

Coarse-textured soils (all soil associations in Table 2-6) have reclamation limitations. Natural fertility level is very low and organic matter content is nearly zero. Soils depths range from 13 to 60 inches, with texture from sand to loamy sand. These soils have high permeability rates, resulting in low water-holding capacity. Plant growth is mainly dependent on precipitation because available water within the plant's root zone is limited. The lack of plant growth results in active wind erosion.

Fine-textured soils (all soil associations in Table 2-6) also have reclamation limitations. Natural fertility and organic matter is very low. Soil depths range from 10 to more than 40 inches, and textures range from silty clay loam to clays. These soils have high runoff rates resulting in low water intake. Water found in fine-textured soils is often near the surface and lost to plant growth because of evaporation. Wind erosion is high for these soils.

Soil data regarding reclamation was taken from the sources cited above in the soils section of this chapter, and the BLM's Energy Mineral Rehabilitation Inventory and Analysis (EMRIA) reports dating from 1976 through 1981.

WATER RESOURCES

Surface Water

(Please refer to the last section of this chapter.)

Ground Water

The EIS Region coincides approximately with the San Juan Structural Basin as defined by Kelley (1951); this basin is larger than either the San Juan River Basin or the San Juan Underground Water Basin declared by the New Mexico State Engineer (refer to Figure 2-4).

Generally the bedrock aquifers crop out on the topographically and structurally higher margins of the basin and dip underground towards the central, lowest part of the basin (refer to Figure 2-5). Alluvium (valley fill deposit) occurs in most of the stream channels of the basin.

Most recharge to the bedrock aquifers occurs where their outcrops are crossed by streams. Water in bedrock aquifers flows from recharge areas (where it occurs under water-table conditions) generally downdip towards the basin center (where it occurs under artesian conditions). Movement of ground water between aquifers may occur via numerous faults that exist throughout the basin. Water in alluvium flows downslope in the same directions as streamflow.

Natural discharge of ground water from San Juan Structural Basin aquifers generally occurs as the water moves towards the Four Corners region and the Rio Grande Valley; some ground water moves southwest towards the Puerco River, near Gallup (refer to Figure 2-4). Lyford (1979) provides an excellent general description of San Juan Basin ground water hydrology. Stone, et al. (in press) present detailed information about this hydrology.

Wells can be used to supply water for stock use in most of the San Juan Structural Basin, but yields are frequently small and water quality is commonly marginal. At least 20 bedrock geologic layers are known to yield water to wells.

Water Quality

The quality of ground water in the EIS Region generally ranges from fresh to moderately saline (classification of Swenson and Baldwin, 1965). In many areas of the San Juan Structural Basin, the total dissolved solids concentration exceeds the Environmental Protection Agency's recommended limit of 1,000 milligrams per liter (mg/l) for potable water (EPA 1972).

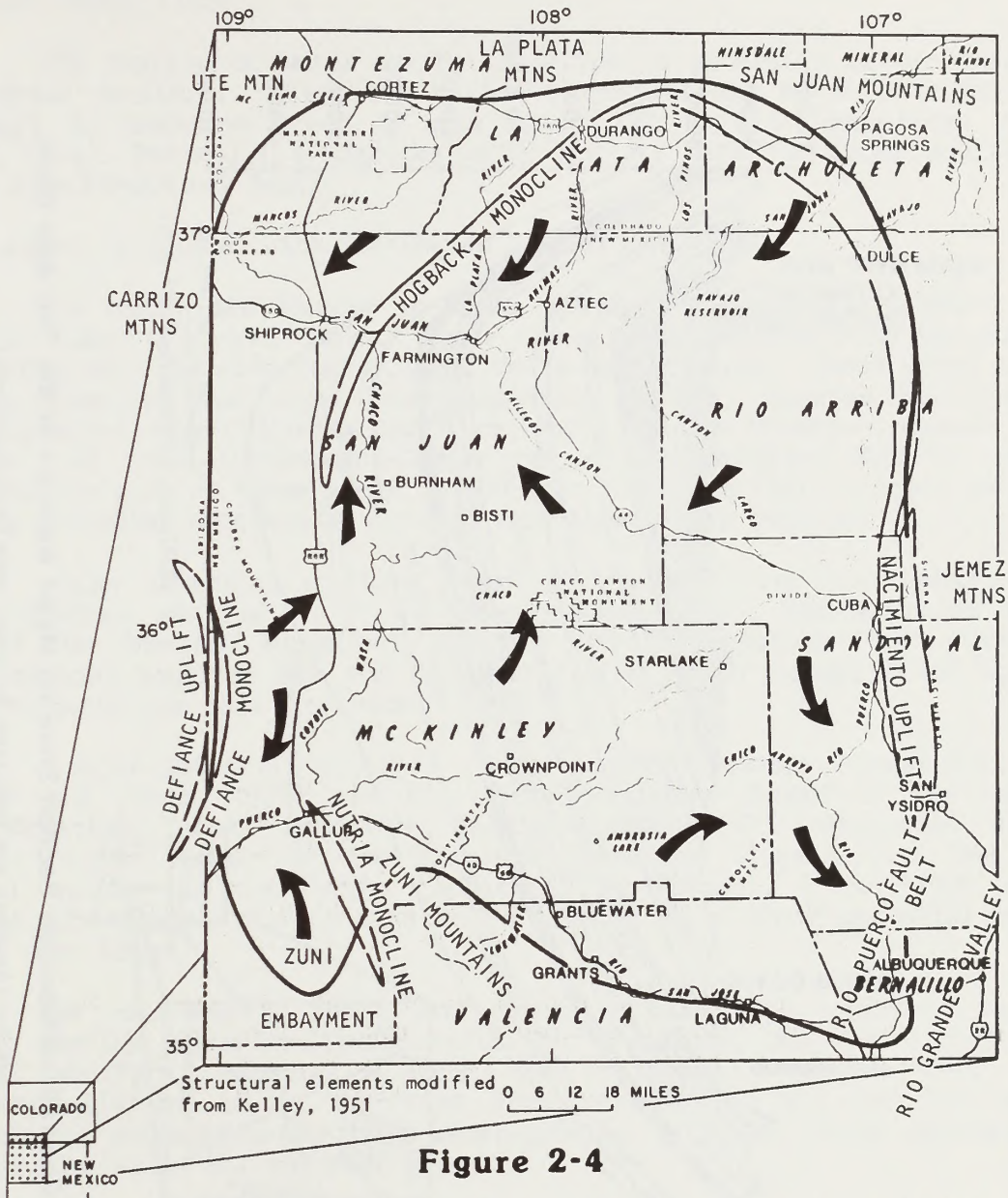


Figure 2-4

STRUCTURAL ELEMENTS OF THE SAN JUAN BASIN LOCATION OF THE EIS AREA, AND GENERALIZED DIRECTIONS OF GROUND-WATER MOVEMENT (INDICATED BY ARROWS)

Source: Modified from Lyford, 1979.

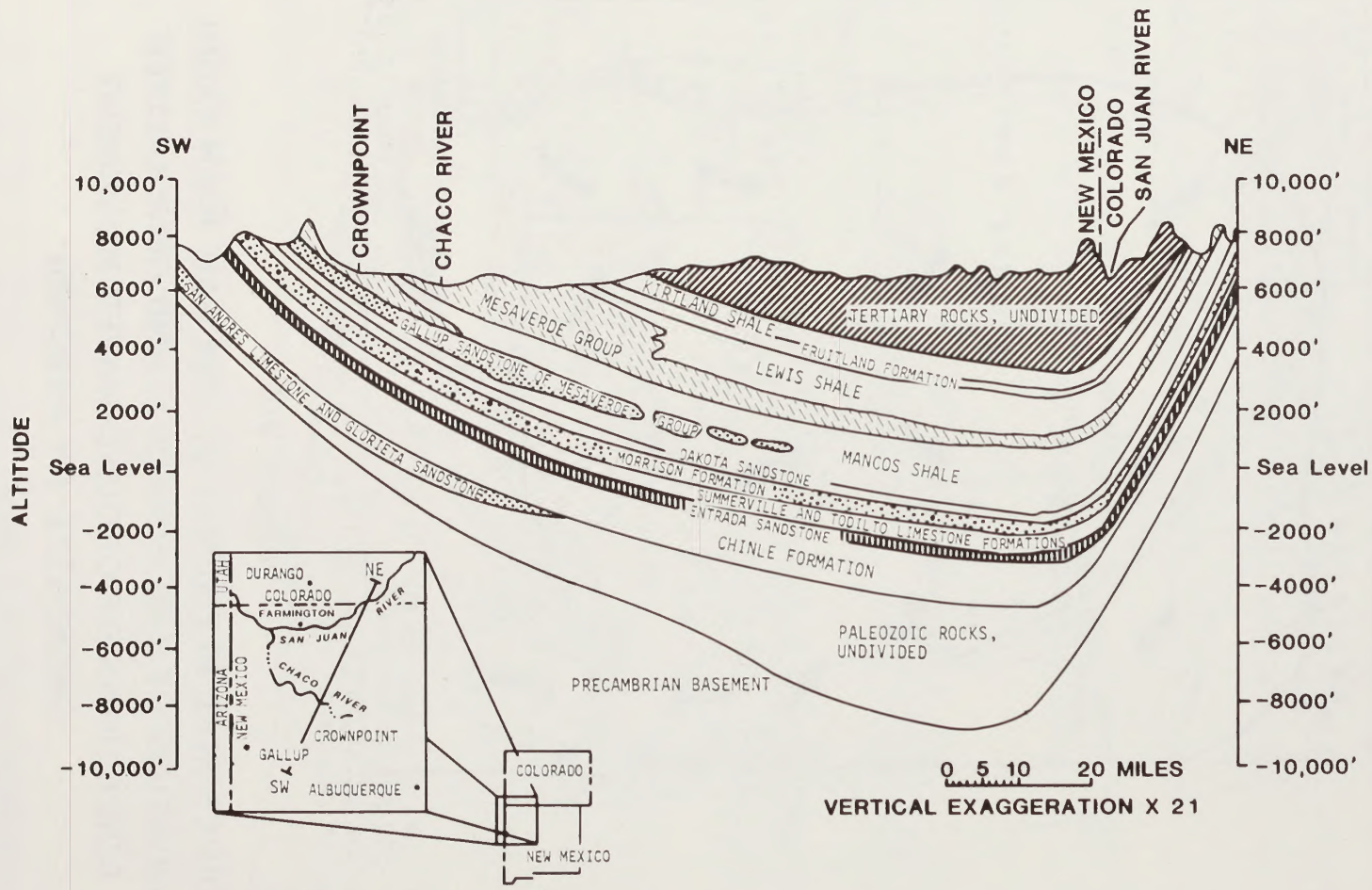


Figure 2-5. Generalized Geologic Section Showing Major Aquifers in the San Juan Basin

Note: (Aquifers are indicated by areas with visual patterns)

Source: Lyford 1979.

The quality of water in bedrock aquifers is commonly best near the outcrop, or recharge, areas of those aquifers. Water quality tends to decrease with distance from outcrops because the water dissolves minerals in the rocks as it flows through them. These water quality trends have been shown by Lyford (1979) and Craigg (1980).

The quality of water in the alluvium is generally better than that from bedrock aquifers. Dissolved solids concentrations range from less than 1,000 mg/l in headwater areas to more than 2,000 mg/l in downstream reaches (Lyford, 1979). Table 2-7 summarizes water quality data for major aquifers in the San Juan Structural Basin.

Aquifers Associated with EIS Region Coal Tracts

The tracts are located in three hydrostratigraphically distinct areas at the San Juan Structural Basin. These three areas coincide with the outcrops of the three main coal-bearing geologic units in the basin. These units are the Fruitland Formation coal trend (Star Lake-Bisti regions), Menefee Formation coal trend (Torreon-Arroyo Chico-Lee Ranch regions), and the Menefee-Crevasse Canyon Formation coal trend (Crownpoint-Gallup regions). Different aquifer combinations underlie each of these areas. Shoemaker and Stone (1976) identified major and minor potential aquifers associated with these three regions.

Major potential aquifers underlying the Fruitland coal trend are the Gallup Sandstone west of R. 11 W. (of Cretaceous age), the Westwater Canyon Member of the Morrison Formation, and the Entrada Sandstone (both Jurassic). Minor potential aquifers are the Pictured Cliffs, Cliff House, Point Lookout, and Dakota Sandstone (all Cretaceous).

Major potential aquifers in the Menefee-Crevasse Canyon coal trend (Shomaker and Stone, 1976) are the Dalton Sandstone Member of the Crevasse Canyon Formation, "stray" sandstone, Gallup Sandstone (all Cretaceous), and the Westwater Canyon Member of the Morrison Formation (Jurassic). One minor potential aquifer is the Dakota Sandstone (Cretaceous). The Point Lookout Sandstone (Cretaceous) should also be considered as a minor potential aquifer for this coal trend.

The coal-bearing formations themselves are also important aquifers locally. The Ojo Alamo Sandstone, Nacimiento Formation, San Jose Formation are potential aquifers, especially along the Fruitland Formation coal trend. Quaternary alluvium is an important local aquifer in all the EIS Region. Hydrogeologic characteristics and water-quality data for these aquifers are summarized in Tables 2-7 and 2-8.

Water Use

Ground water in the EIS Region is withdrawn for various purposes, the most predominant of which include uranium mine dewatering (mostly from the Westwater Canyon Member of the Morrison Formation), milling of ore, various industrial activities municipal supplies, rural domestic needs, and livestock watering.

Legal constraints are placed on the use of ground water in the region. Use is administered by the New Mexico State Engineer, who has declared four underground water basins within the San Juan Structural Basin. These are the

TABLE 2-7

HYDROGEOLOGIC CHARACTERISTICS
OF MAJOR AQUIFERS IN THE SAN JUAN BASIN

Aquifer	Formation Thickness (ft)	Transmissivity [a] (ft^2/day)	Specific Capacity [a] (gal/min/ft)
Alluvium	0-100	>40,000 (Along San Juan, La Plata, and Animas Rivers)	
		<1,000 (Along ephemeral streams)	
San Jose Formation	0-3,000	<150	
Nacimiento Formation	800-2,000		
Ojo Alamo Sandstone	0-400	57-165	0.2-1.02
Fruitland Formation	0-500		
Pictured Cliffs Sandstone	75-375		0.02-0.07
Cliff House Sandstone		<50-100	0.05-0.12
Menefee Formation	100-2,000	25-50	0.03-1.38
Point Lookout Sandstone	75-350	<50-100	0.07-1.12
Crevasse Canyon Formation	100-1,000	<50-100	0.03-0.64
Gallup Sandstone	0-500	<100-270	0.03-4.7
Dakota Sandstone	0-250		0.05-0.2
Westwater Canyon Member of Morrison Formation	50-800	36-510	0.27-1.6
Entrada Sandstone	50-400	<50-300	0.02-3.5

Source: USDI, BIA 1980; USDI, BLM 1979; Lyford 1979; Woodward-Clyde 1982; Craigg 1980.

Note: [a] Refer to Glossary for a definition of these terms.

TABLE 2-8
PHYSICAL PROPERTIES AND CHEMICAL QUALITY
OF MAJOR AQUIFERS IN THE SAN JUAN BASIN

Aquifer	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium & Potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved Solids	Total Hardness (Units)	pH	Temperature (°C)
Alluvium	4.1-63	0-6.6	4-2,870	0.8-2,040	5.5-12,000	34-1,000	2.5-8,890	2-27,500	0-11	0-439	143-47,100	18-15,500	7.3-8.3	4-21
San Jose Formation	7.6-28	0.02-14	1.6-365	0-67	29-745	120-814	71-1,430	3.2-87	0.2-4.0	0-25	323-2,520	4-1,960	6.5-9.2	9-14
Nacimiento Formation	14-22	0.02-0.58	0-385	0-50	3-2,415	0-478	6.2-5,455	1-145	0-4	0.2-5.7	56-14,150	30-966	6.9	12
Ojo Alamo Sandstone	9.6-39	0-2.1	1.6-548	0-126	23-788	0-888	0.4-2,440	0.8-923	0.3-1.8	0-70	275-4,010	4-1,860	6.5-8.9	2-14
Pictured Cliffs Sandstone	11-20	0-0.24	1.9-425	1-217	50-16,600	209-2,400	7.3-4,400	19-26,600	1.2-5.5	0-8.6	383-44,200	11-1,950	7.4-9.1	3-19
Ciff House Sandstone	2.7-19	0-0.01	2.2-280	0.7-170	26-6,140	0-1,250	350-8,230	7-4,210	0-8.1	0.1-2.5	849-3,120	8-1,600	4.3-8.9	13-18
Menefee Formation	5.1-21	0-1.1	1-168	0-34	8-2,620	92-1,890	1.8-3,930	1.5-956	0-12	0-19	129-7,780	4-534	7.4-9.1	12-21
Point Lookout Sandstone	0.05-39	0-0.31	0-684	0.4-267	13-833	116-826	3.8-3,410	2.2-113	0.2-3.7	0.1-14	149-5,080	5-2,800	7.4-10.0	13-21
Crevasse Canyon Formation	5.5-24	0-3.6	1.3-630	0-245	0.9-1,002	122-1,030	9.2-2,980	1.4-94	0-2.0	0-427	243-4,470	4-3,100	6.8-9.1	12-20
Gallup Sandstone	10-38	0.02-15	1-456	0-268	16-1,690	85-763	17-2,854	4-1,940	0-6.8	0-40	285-4,400	4-2,240	7.2-8.8	9-42
Dakota Sandstone	6.5-42	0-7.8	1.5-330	0.9-103	5.8-1,430	130-1,600	7.8-3,540	6-500	0.1-10	0.1-10	165-5,560	9-1,080	7.2-8.4	13-23
Westwater Canyon Member Morrison Formation	6.2-29	0-4	1.2-373	0.2-188	9.2-1,430	60-1,200	11-3,540	0.8-374	0-1.4	0-200	168-5,560	4-1,700	7.2-9.2	14-52
Bluff Sandstone	7.4-18	0-0.39	7.5-221	2.2-106	24-949	168-898	17-2,380	12-118	0.2-5.1	0.1-18	264-3,760	20-988	7.5-8.3	11-24
Entrada Sandstone	9.1-27	0.09	1.2-262	0.2-64	15-543	83-539	5.8-1,930	5-2,230	0.2-1.6	0-33	196->5,000	4-916	9.2	17
Chinle Formation	3.9-45	0-1.2	0.4-304	0.5-587	1.2-5,740	34-1,150	16-4,110	5-9,590	0.1-5.9	0-129	171-6,410	3-3,170	6.8-9.1	12-20
San Andres Limestone	6.7-23	0-1.2	60-266	14-128	1.2-426	161-702	11-1,030	4-254	0-0.8	0-105	272-2,370	72-1,040	6.7-8.2	11-46
Glorieta Sandstone	8.2-13	3.4-4.1	100-183	15-87	9.2-1,330	184-265	230-637	5-1,980	0.1-0.8	0-1.7	567-4,330	412-779	7.2	13-26

Source: USDI, BLM, BR AND GS 1976.

San Juan, Bluewater, Gallup, and Rio Grande Underground Water Basins. Once an area has been designated as an underground water basin, permits must be obtained from the State Engineer before ground water may be appropriated. Permits are issued only after public notice and are subject to protest by parties holding prior existing water rights.

Floodplains

The Federal Insurance Administration (FIA) has mapped the floodplains associated with each major drainageway in the EIS Region. Table B-1 in Appendix B summarizes approximate floodplain acreages for these drainageways, based on the FIA's Flood Hazard Boundary Maps. Floodplain acreages are approximate and were calculated only for those tracts identified as surface mineable by the Minerals Management Service. For maps showing the areal distribution of floodplains within each surface-mineable tract, the reader is referred to file material in the BLM Farmington Resource Area Office.

Development in floodplains is uncommon, but usually consists of fencelines or shallow wells completed in alluvium. Single-family dwellings may exist in some floodplain areas.

VEGETATION/THREATENED, ENDANGERED AND SPECIAL INTEREST PLANTS/LIVESTOCK GRAZING

Vegetation

Vegetation for the 39 tracts is represented by 11 vegetation types. The vegetation types are sagebrush, pinyon juniper, grassland, greasewood, fourwing saltbush, salt flats-halophytic, riverwash-wetland, duneland, ponderosa pine, badland and rock outcrop. These vegetation types are discussed in Appendix C. For more information about the occurrence of these vegetation types, refer to the Chaco-San Juan Planning Unit Resource Analysis--Update for Coal (USDI, BLM 1980b).

Threatened, Endangered and Special Interest Plants

There are no known populations of federally listed threatened or endangered plant species in the EIS Region. A 1982 printout from the New Mexico State Heritage Program shows no location of these species in the region, but identifies Astragalus wingatus, a state sensitive species, on the Catalpa Canyon and Hogback tracts.

Livestock Grazing

Livestock grazing has been historically, and is presently, the primary use of EIS Region. On most of the community allotments within the region, the majority of operators are individual Navajo family units who run small bands of sheep and goats. Many operators reside on or near the allotment(s) their livestock graze, and herd their livestock to and from their dwellings daily. More information concerning these allotments is on file at the Farmington Resource Area Office and the BIA office in Crownpoint.

The complex surface ownership pattern in the EIS Region has severely limited livestock management by the BLM. Only those public land blocks with little or no interspersed Indian allotted lands are currently managed by the BLM.

Indian grazing allotments with small scattered tracts of public lands are administered by the Bureau of Indian Affairs (BIA) through a cooperative agreement with the BLM. The BLM leases these allotments to the Navajo Tribe, and has set carrying capacities for the public lands within the allotments. Because of the complex land pattern and special rulings under which the BIA allotments are administered, the BLM has no knowledge of actual livestock operators, livestock numbers, class of livestock, or range developments on many of these allotments.

WILDLIFE/THREATENED OR ENDANGERED ANIMALS

The BLM and the State of New Mexico have not identified critical habitat in the EIS Region for any wildlife species. In the southern portion of the region (the area encompassing all the tracts except the La Plata tracts), relatively few big game and non-game animals occur except during the migration of song birds. No riparian and little cottonwood-type habitat associated with washes exists in the EIS Region. A list of wildlife found in the region may be found in the Chaco-San Juan Planning Unit Resource Analysis--Update for Coal (USDI, BLM 1980b) on file at the BLM Farmington Resource Area Office.

In the northern part of the EIS Region, the BLM has identified important mule deer and elk winter range. Approximately 200 acres of this range is found on the La Plata #1 Tract, and 105 acres exist on the La Plata #2 Tract.

Within the PRLA Area, five raptor nesting sites have been identified (Appendix A-7), and on the competitive coal tracts outside the PRLA Area, two raptor nesting areas were found (Appendix A-8).

No habitat for federal threatened or endangered wildlife species has been identified in the biological assessment prepared for Section 7 Consultation (Endangered Species Act of 1973) with the U.S. Fish and Wildlife Service (refer to Appendix D). However, potential habitat exists for the black-footed ferret. A black-footed ferret survey was conducted by a biologist employed by the Public Service Company of New Mexico on a Gunnison's white-tailed prairie dog town of approximately 400 acres in size (T. 22 N., R. 12 W., Sections 2, 3). No ferret sign or activity was found (Berger, 1981, personal communication). Neither did biologists working for BIO/WEST, Inc. (1982) report ferret sign or activity at other locations.

A small spring on the Johnson Trading Post Tract provides important habitat for roosting long-eared owls and for migrating songbirds.

CULTURAL RESOURCES

Cultural resources consist of the fragile and nonrenewable remains of past human activity, occupation, or endeavors. These endeavors are reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, and natural features important in human events. Cultural resources span a period of at least 12,000 years. Archaeologists have divided this period into five temporal/cultural periods in the San Juan Basin.

The earliest evidence of humankind in the San Juan Basin is from PaleoIndian sites (10,000-5,000 B.C.). These sites indicate a cultural adaptation to the hunting of Pleistocene animals, including extinct bison and

mammoth, the hunting of smaller game, and the gathering of wild edible plants.

The end of the Pleistocene and beginning of the Holocene are partially marked by the extinction of the larger animals, along with a climatic change. Archaic period (5,000 B.C. - A.D 1) sites show an emphasis on the hunting of smaller game and a greater importance placed on the gathering of plants.

The transition towards a sedentary lifestyle and the adaptation of horticulture mark the beginning of the Anasazi culture (A.D. 1- A.D. 1300). The Chacoan Anasazi culture was present throughout the San Juan Basin between A.D. 900 and A.D. 1200. This cultural system included at least 80 communities and numerous smaller sites besides the pueblos within Chaco Canyon. The outlying communities contained multi-story structures ranging in size from 10 rooms to 100, while at Chaco Canyon, pueblos containing over 800 rooms were built .

Much of the San Juan Basin was abandoned between A.D. 1300 and 1500, when the Navajo Indians entered from the north-northeast. The final cultural group to enter the basin was the Euro-Americans in about 1550, led by Spanish missionaries and explorers. Later came Spanish and Anglo settlers. Further data on the cultural sequence in the San Juan Basin can be obtained in USDI, BLM (1979c), Huse et. al. (1978), Magers (1979), Delaney and Dosh (1981), and Kemrer (1981).

As shown in Table 2-9, 231 sites have been recorded on the competitive coal lease tracts containing federal coal or federal surface. Of these, 130 are prehistoric, 141 are historic and 3 are sites of unknown affiliation. Between 5 and 10 percent of the EIS Region underlying federal coal has been inventoried for cultural resources.

Site densities have been estimated for each tract, using a predictive model (developed for the BLM by the ESCA-Tech Corporation in 1981) and known site densities from surrounding areas. Between 1,727 and 2,295 sites are predicted on these tracts. (Sites predicted to occur in the areas of private coal are not included.) Additional sites will likely be located during the BLM Chacoan Roads project conducted during the summer of 1982 (in press), but data from this project is unavailable at this time.

Of the 231 recorded sites, 40 contain evidence of more than one component (refer to the Glossary), 37 have two components, and 3 have three components. Sites recorded on the tracts represent four of the five temporal/ cultural periods. Although no PaleoIndian sites are known to have been recorded on the tracts, a portion of the indeterminate lithic scatters (lithic scatters without diagnostic artifacts) may have been made by PaleoIndians. A site containing a Plano point (7,500-5,000 B.C.) has been found within 2 miles of the Star Lake West tract, and it is predicted that PaleoIndian sites may occur on the tract.

Eighteen of the recorded components have been assigned to the Archaic period, and additional Archaic sites may be represented in the indeterminate lithic scatters. The majority of the recorded components contain either diagnostic projectile points or milling stones. The area between Bisti and Star Lake has been identified as an opportunity area for Archaic culture study due to the concentration of sites. Research here may provide important archaeological data on the Archaic occupation of the San Juan Basin.

TABLE 2-9

CULTURAL RESOURCES ON THE COMPETITIVE COAL LEASE TRACTS

Tract Name	Percent Inventoried	Total Sites: Known	Total Sites: Predicted	Total Sites: Source of Prediction a/	Site Component Affiliation: Paleo-Indian	Indeterminate Lithic	Archaic	Anasazi	Navajo	Hispanic	Historic	Unknown	Total	Chacoan Roads	Agricultural Soils
Crownpoint NE	1	0	10	1										x	
La Plata 1	10	3	15	1				2				1	3		x
La Plata 2	10	3 b/	15	1				3 b/			1		4		x
La Plata 3	4	2	15	1				2					2		x
La Plata 4	5	6 b/	45	1				4 b/	1		2		7		x
Twin Buttes	0	0	234	1											x
Johnson Trading Post	1	1	23-48	1					1				1		
Pinehaven	10	19	191	1		3	1	11	6		3		24		
Hospah 1	2	4	33	1		1					3		4	x	x
Hospah 2	12	0	13	1											
Kimbeto 1	20	6	50-60	2		3	1		3				7		
Kimbeto 2	10	3	8	3		2		1	1				4		
Samson Lake 1	1	1	32-147	1				1			1		2		
Samson Lake 2	1	1	16-73	1				1					1		
Gamerco 1	0	0	1-6	1											
Gamerco 1 Bypass	44	0	3-13	1											
Gamerco 2	2	0	17-76	1											
Divide	11	5	45-105	1				1	2	3			6		x
Star Lake East 1	7	3	15-35	1			3		2				5		x
Star Lake East LC	1	0	15-31	1											x
Star Lake West 2	15	0	6-13	1											x
Crownpoint East	6	15	128-208	1					15				15	x	x
Bisti 1	7	9	43	3		5		2	2				9		
Bisti 2	10	8	12	3		4	4				2		10		
Bisti 4	1	1	20-86	2		1							1		
Bisti 6-8	1	2	14	3			1		1				2		
Gallo Wash 1	0	0	6	3											
Gallo Wash 2	2	0	6	3											
Lee Ranch East	0	0	7	1											x
Lee Ranch Middle	5	8	32-43	1		2	1	1		1	4		9		x
Lee Ranch West	10	28	70-100	1		15	3	4		1	11		34	x	x
Ta-Ha-Bah	0	0	67	1											
Bread Springs 1	0	0	16	1											
Bread Springs 2	0	0	27	1											
Sundance	69	17	23	1				2	14		1		17		
Catalpa Canyon	100	0	0	1											
Chico Wash South	1	4	76	1		3		2	1				6		
Nageezi	20	83	336	2		16	4	21	49		10	2	102	x	
Hogback	0	0	39	1											
TOTALS		231 c/	1,727-2,295		0	55	18	57 c/	98	5	38	3	274 c/		

Notes: a/ 1. Predicted site number from within, adjacent or nearby site data.
2. Predicted site number from combination of above two sources.
3. Predicted site number from Kemrer, 1981.

b/ Site LA 5605 is in both La Plata 2 and 4. Here denoted in both tracts.

c/ For total site summary and component summary, LA 5605 is only counted once.

The 57 Anasazi components date from Basketmaker II (A.D. 1-500) through Pueblo III (A.D. 1100-1300), with the highest frequency being Pueblo II (A.D. 900-1100). A portion of the indeterminate lithic scatters may also be Anasazi.

During the Bonito Phase of the Anasazi period, outlying sites across the San Juan Basin were connected to Chaco Canyon by an extensive network of roadways. Archaeologists are only beginning to realize the complexities of this site and road network, which is sometimes called the "Chaco Phenomenon." The major sites along these roads and other large Bonito-phase sites are referred to as "Chacoan Outliers."

The Pierre's Ruin Community, a Chacoan outlier, is partially within the Nageezi Tract (refer to Figure 2-6). A total of 440 acres has been included as a protection site under Public Law 96-550, and 420 acres of the protection site plus an additional 540 acres have been nominated to the National Register of Historic Places. An additional 580 acres are proposed for inclusion into P.L. 96-550. Of this 580 acres, 160 acres are within the National Register nomination area. The BLM and the National Park Service have discussed the possibilities of developing the Pierre's Ruin Community for visitor interpretation along with Chaco Canyon (the Chaco Culture National Historical Park) and the Chacoan Outliers.

Many of the outliers and smaller Anasazi farming communities and sites are located in or adjacent to areas of productive agricultural soils (Loose, 1978). It is predicted that farming communities or sites may occur on the 11 competitive lease tracts containing productive agricultural soils.

Two prehistoric Chacoan roads pass through five tracts: Nageezi, Lee Ranch West, Crownpoint Northeast, Hospah #1, and Crownpoint East. Archaeological surveys of the road segments on the Nageezi Tract and areas north and south of Chaco Canyon have recorded several small sites associated with the roads and definable road segments (USDI, BLM in press). The features and definable segments have been assigned site numbers, but the roads themselves do not have numbers.

The 98 Navajo components date from the post-Gobernador phase (A.D. 1753-1868) and the Herding-Raiding/Post-Bosque Redondo phase (A.D. 1800-1881) to the present. Earlier Navajo sites are known to occur outside of the competitive lease tracts and may occur in them. Like the above prehistoric sites, early Navajo sites may account for a portion of the indeterminate lithic scatters. Navajo sacred sites, gravesites, and currently occupied sites are discussed in the American Indian Concerns section of this chapter.

Euro-American sites consist of Hispanic and undifferentiated historic sites. Five Hispanic components have been recorded. They are in the Divide and Lee Ranch tracts. The undifferentiated historic sites include habitation sites, temporary/seasonal usage sites, trash, and any other feature to which cultural affiliation could not be assigned.

Three additional components have been recorded for which a culture or time period could not be determined. They are considered sites of unknown affiliation.

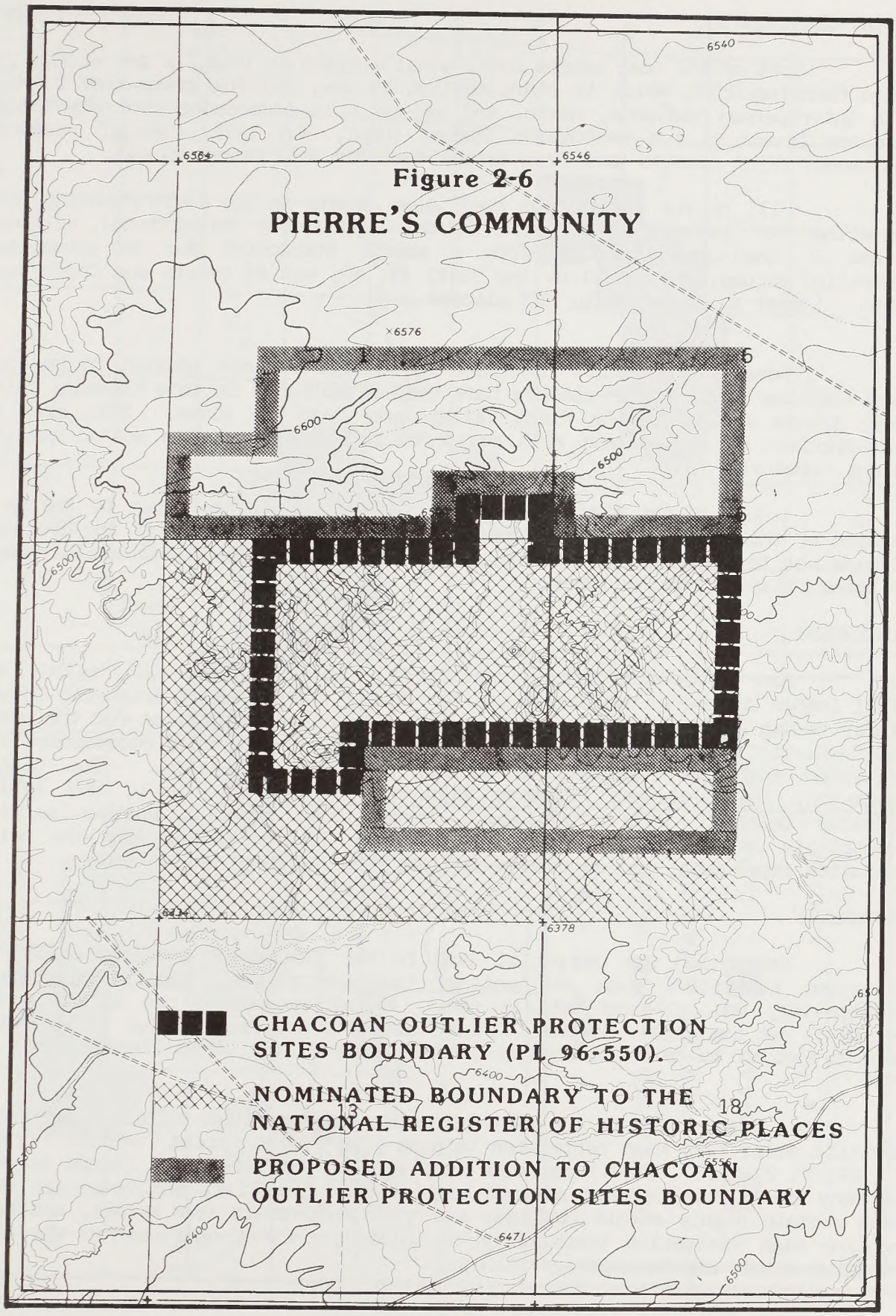


Figure 2-6

PIERRE'S COMMUNITY

VISUAL RESOURCES

Most of the coal tracts under consideration in this EIS are within the Chaco Planning Unit, which is characterized by low, rolling grass-sage terrain with interspersed badlands, mesas, and washes. In accordance with the Visual Resource Inventory and Evaluation System (USDI, BLM 1978), visual resource management (VRM) classes have been established for this Planning Unit.

All of the competitive coal lease tracts in the Chaco Planning Unit are either VRM Class III or IV (refer to the Glossary for definitions), although a few of them are important from a scenic standpoint due to associated recreation values. These include the Bisti #2, #4, and #8 tracts and Chico Wash South. (Refer to Visual B for VRM classes.)

Four of the tracts (La Plata #1 through #4) are located in the San Juan Planning Unit; no VRM classes have been established in this Planning Unit. These tracts are in the La Plata Valley away from the river. This area is characterized by pastureland with scattered pinyon-juniper; the scenic quality is not especially high.

All of the BLM's Wilderness Study Areas (WSAs--refer to the next section of this chapter) are designated as VRM Class II Areas. If the decision is made not to designate the Ah-shi-sle-pah WSA as wilderness, it would revert to being Class III and IV lands.

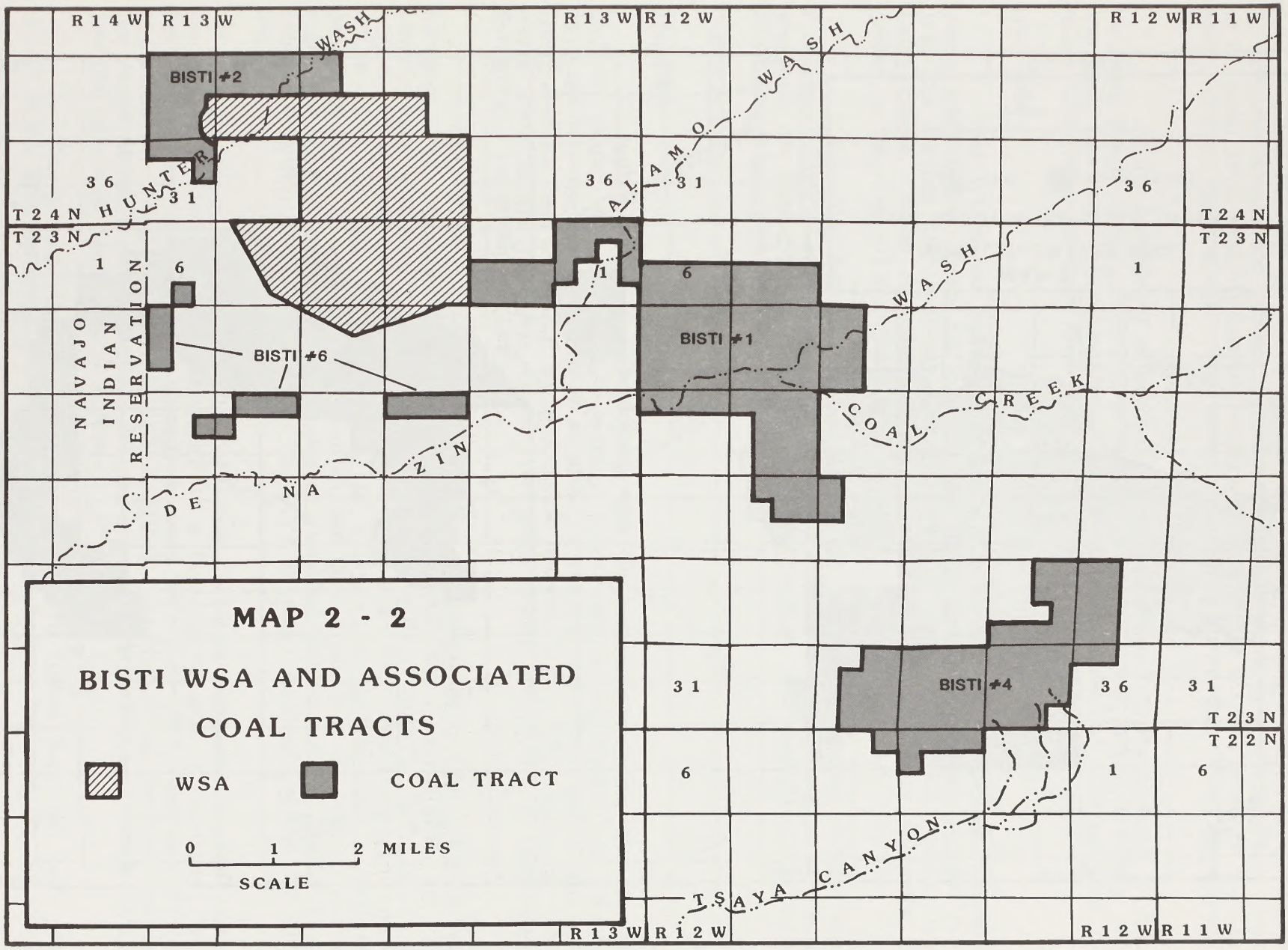
WILDERNESS

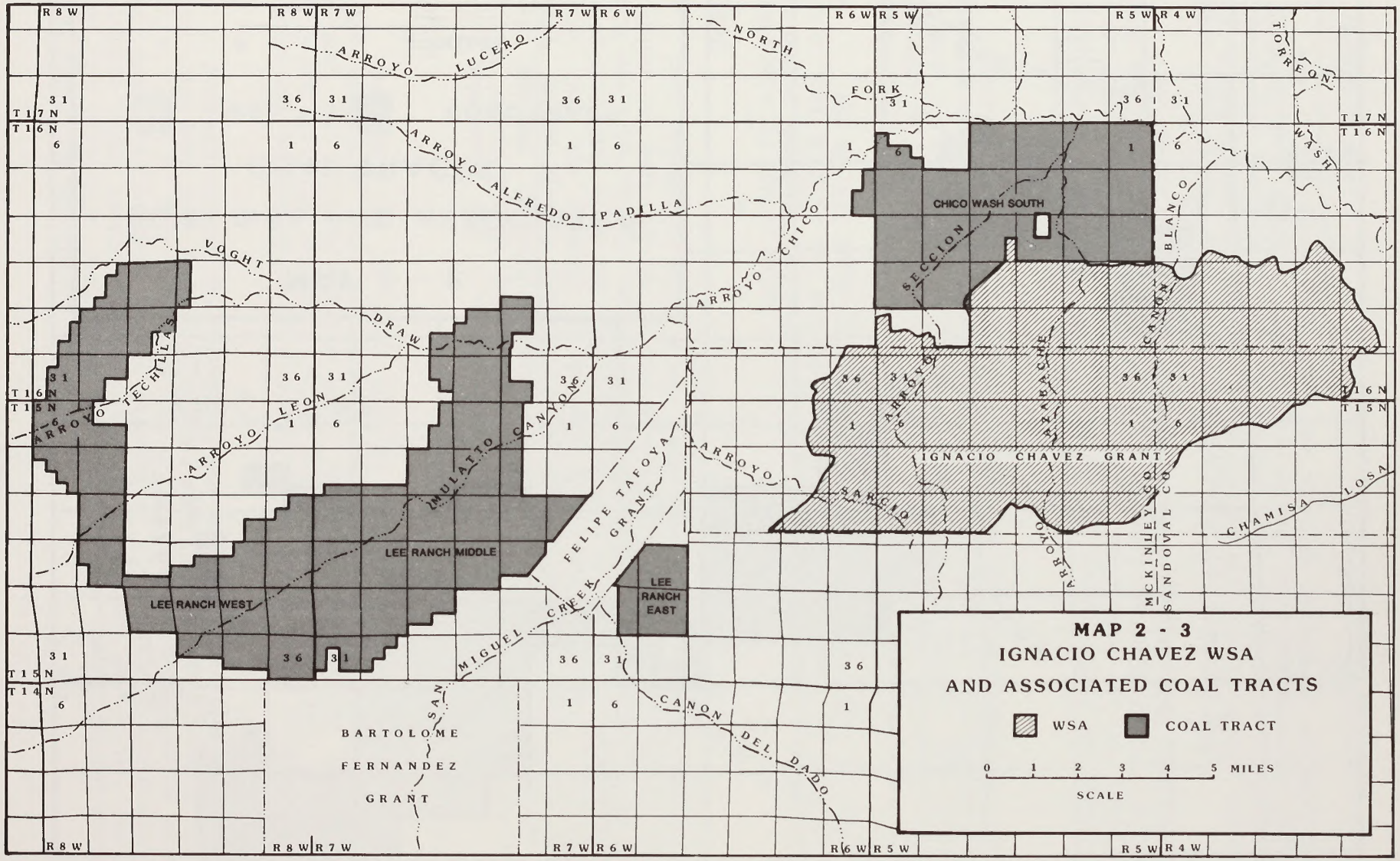
Four Wilderness Study Areas (WSAs) lie within the EIS Region, the Bisti (refer Map 2-2), the De-na-zin, the Ah-shi-sle-pah and the Ignacio Chavez (refer to Map 2-3). The BLM has recommended wilderness designation for the Bisti and De-na-zin WSAs, while the Ah-shi-sle-pah WSA is not being recommended for inclusion into the National Wilderness Preservation System. The Bisti, De-na-zin, Ah-shi-sle-pah Proposed Wilderness Areas EIS (USDI, BLM 1982b) contains detailed information about these three WSAs. Studies on the suitability of wilderness designation for the Ignacio Chavez WSA are being conducted separately, and no recommendations have yet been made.

RECREATION

Recreation use on public land in the EIS Region consists mostly of dispersed activities such as hunting, backcountry use, fossil collecting, sightseeing, and off-road vehicle use. Actual recreation use data for the region is not available; however, 179,235 activity occasions (refer to Glossary) were projected to have occurred on public lands in the Chaco Planning Unit in 1980.

Although much of the recreation use in the region is dispersed, some specific areas have high recreation values. The Fossil Forest (Section 13, 14, 23, 24, T. 23 N., R. 12 W.) contains many in situ petrified tree stumps as well as many other fossils that attract sightseers. The Bisti and De-na-zin WSAs both contain highly scenic badlands and good backcountry use values, and both receive high visitation (especially the Bisti). The Ah-shi-sle-pah WSA also contains scenic and backcountry values.


R 14 W
R 13 W
R 12 W
R 11 W
T 24 N
T 23 N
T 22 N
BISTI #2
BISTI #1
BISTI #6
BISTI #4
HUNTER WASH
ALAMO WASH
COAL CREEK WASH
DEZINA
TSAYA CANYON
NAVAJO INDIAN RESERVATION
36
31
1
6
MAP 2 - 2
BISTI WSA AND ASSOCIATED COAL TRACTS
WSA
COAL TRACT
0 1 2 MILES
SCALE


R 8 W
R 7 W
R 6 W
R 5 W
R 4 W
T 17 N
T 16 N
T 15 N
T 14 N
ARROYO LUCERO
NORTH FORK
TORREON WASH
ARROYO ALFREDO PADILLA
CHICO WASH SOUTH
SECCION
BLANCO CANYON
VOGHT DRAW
ARROYO TECHILAS
ARROYO CHICO
ARROYO LEON
MULATTO CANYON
ARROYO APACHE
IGNACIO CHAVEZ GRANT
FELIPE TAFOYA GRANT
ARROYO SARCILLO
MCKINLEY CO.
SANDOVAL CO.
CHAMISA LOSA
LEE RANCH MIDDLE
LEE RANCH WEST
LEE RANCH EAST
SAN MIGUEL CREEK
BARTOLOME FERNANDEZ GRANT
CANON DEL DADO
MAP 2 - 3
IGNACIO CHAVEZ WSA
AND ASSOCIATED COAL TRACTS
WSA
COAL TRACT
0 1 2 3 4 5 MILES
SCALE

One area in the Bisti WSA has received many management recommendations to preserve scenic and recreation values (through Wilderness designation, Area of Critical Environmental Concern designation, National Natural Landmark status, and a mineral withdrawal). This area is referred to as the "Bisti Management Area".

Public Law 90-543 of October, 1968, established the Continental Divide National Scenic Trail (CDNST) from Mexico to Canada. The actual treadway for the CDNST has not been established, but the basic study route is a corridor 30 miles wide (refer to Map 2-4).

LAND USES

Facilities and improvements traversing the EIS Region include numerous power transmission lines and oil and gas pipelines. Appendices E-1 and E-2 list the various rights-of-way crossing the individual PRLAs and competitive lease tracts. These rights-of-way would fall under unsuitability criterion 2 (refer to the discussion in Chapter 1 regarding the unsuitability criteria).

Appendix E-3 lists the land use proposals located within the Preference Right Lease Applications and competitive lease tracts. These proposals are discussed in Chapter 1 under the heading, "Interrelationships with Other Projects in the Region".

TRANSPORTATION

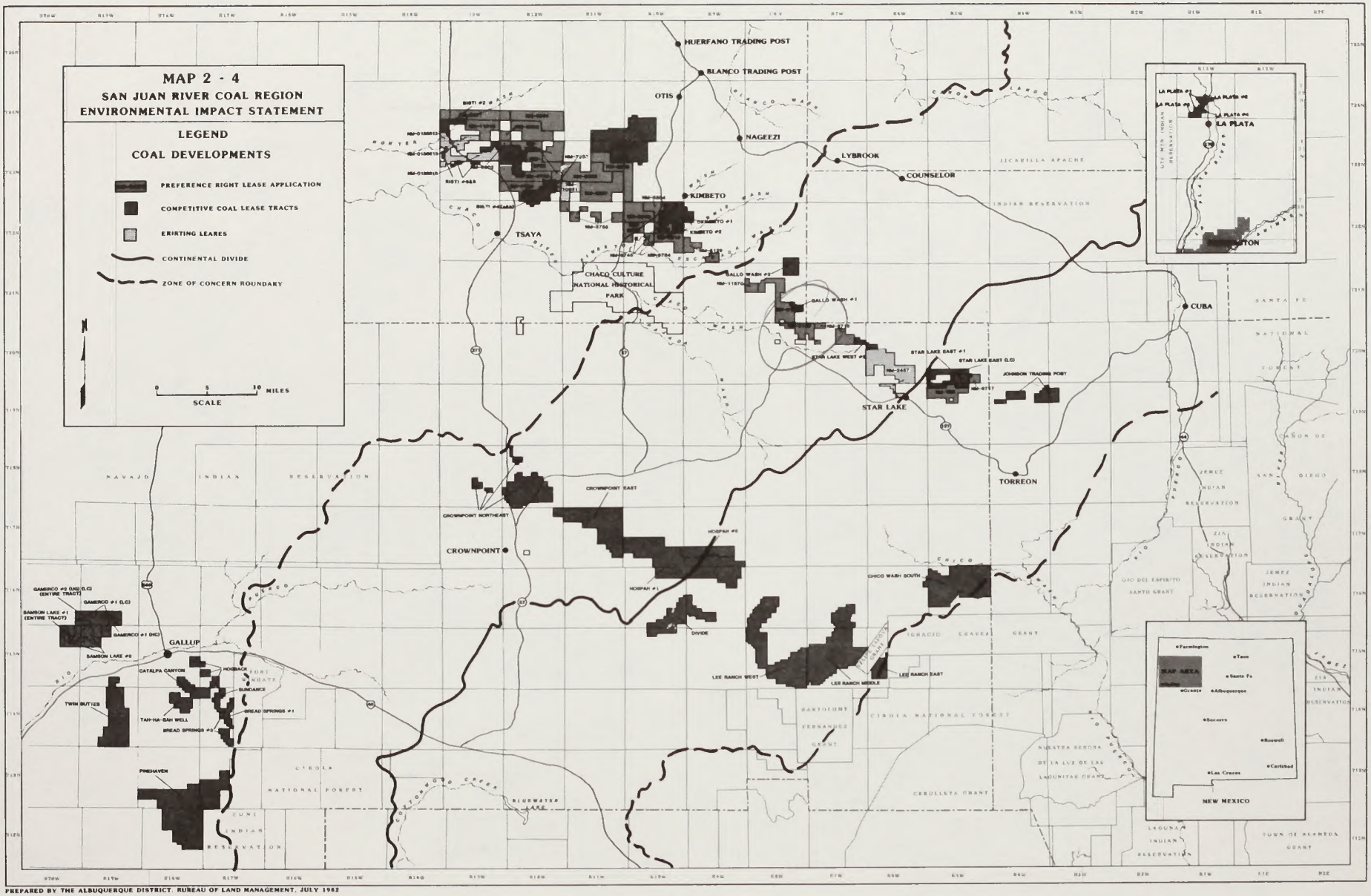
Highways

Public roads accessing rural and suburban areas in the EIS Region include state highways, county roads, county-maintained roads, and roads maintained by the Bureau of Indian Affairs. State Highways NM 44 and NM 550 and Interstate 40 form the major transportation network in the EIS Region. The roads crossing the PRLAs and competitive lease tracts are listed in Appendices E-4 and E-5 and shown on Visual C.

Many of the highways carry loads beyond design capacities. Road beds, surfaces, and shoulders of many highway segments have deteriorated due to increasingly heavy traffic. The average maximum vehicle capacity for a two-lane highway in northwest New Mexico is 1,400 vehicles per hour travelling at a speed of 40 miles per hour. Interstate 40 is a four-lane highway with a maximum design capacity of up to 3,000 vehicles per hour travelling at a speed of 50 miles per hour (New Mexico Highway Dept., Planning Division 1982). Table 2-10 shows the width, design speed, and condition of major highways within the EIS Region.

Increasing population is one cause for this increased traffic load. Average daily vehicle miles of travel in a five-county area of northwest New Mexico rose by more than 80 percent between 1966 and 1977, and automobile registrations nearly doubled (USDI, BLM 1979c). Average daily traffic figures for state highways and Interstate 40 are shown on Table 2-11. Average daily traffic is broken down by vehicle type.

County and other agency roads listed in Tables 2-10 and 2-11 are bladed roads with sparsely gravelled segments. Because the majority of these



PREPARED BY THE ALBUQUERQUE DISTRICT, BUREAU OF LAND MANAGEMENT, JULY 1982

TABLE 2-10

HIGHWAY USE AND CONDITIONS IN THE EIS REGION BY HIGHWAY SEGMENT a/

Interstate or State Highway	Highway Segment	Miles	Surface	Width (in feet)	Design (sp. mph)	Condition Rating b/	Comments on Flow or Condition
NM 32	Gallup to McKinley-Valencia County Line.	41.5	Bituminous	22-44	60	B	13.0 miles judged unsafe, with 9.6 miles of deteriorated foundation c/.
NM 44	Rio Arriba-San Juan County Line to Bloomfield.	43.7	Bituminous	22-36	60	C	27.4 miles judged unsafe, with 17.7 miles of deteriorated surface.
NM 53	San Mateo to Grants.	20.3	Bituminous	22-50	60	C	2.3 miles judged unsafe, heavy traffic flow diminishes operating conditions.
NM 57	Blanco Trading Post to White Rock.	39.7	dirt/gravel	20	40	D	Route unimproved; poorly marked, impassable in wet weather.
	White Rock to Crownpoint	27.0	dirt/gravel Bituminous	24	40	B-D	20.3 miles unimproved, poorly marked, impassable in wet weather of remaining 2.8 miles unsafe, 3.9 miles of deteriorated surface.
	Crownpoint to Thoreau.	21.2	Bituminous	24	60	B	16.9 miles of deteriorated surface.
NM 197	Cuba to Torreon.	25.6	Bituminous	22-28	60	B	4.8 miles judged unsafe due to design.
	Torreon to Crownpoint.	60.0	Bituminous	25	60	A	
NM 371	Farmington to White Rock	57.9	Bituminous	30	40-50	B-D	41.5 miles unimproved, poorly marked impassable in wet weather, 5.0 miles of remainder judged unsafe due to design.
I-40	Grants to Thoreau.	24.8	concrete/ Bituminous	40	70	A	
	Thoreau to Gallup.	27.3	concrete/ Bituminous				

Source: USDI, BLM 1979c.

Notes: a/ Information not available for NM 170 and NM 509.
b/ Condition rating is based on Adjusted Rating of New Mexico Highway Department, With A-75-100, B-50-74, C-25-49, and D-0-24 with A indicating best conditions, D worst, according to terms of New Mexico Highway Department. Ratings for Highway Improvement: Procedures Manual, 1971.
c/ This segment resurfaced and upgraded, 1980-81.

TABLE 2-11

1980 AVERAGE DAILY TRAFFIC AT CONTROL STATIONS (BY VEHICLE TYPE)

Interstate Or State Highway	Highway Segment	Passenger Cars	Single Unit Trucks	Buses	Truck-Tractor Combinations	Misc. Vehicles	Totals
NM 57	12.3 miles N. of R/R crossing in Thoreau	722	1,136	19	113	21	2,191
NM 32	N. of Jct. NM 36, S. of Gallup	713	760	5	42	21	1,541
NM 44	1.5 miles S. of Bloomfield	1,919	2,565	49	468	154	5,155
I-40	5.4 miles W. of Milan	4,477	2,086	50	1,848	549	9,010
NM 53/334	1.5 miles NE of Jct. 66 at Milan	1,804	1,867	7	190	55	3,923
NM 170	N. of Jct. US 550, W. of Farmington	1,687	1,740	13	54	85	3,579

Source: New Mexico State Highway Department 1980.

Note: Figures not available for NM 197, NM 371 and NM 509.

roads connect rural areas, traffic congestion is not a problem; however, increased maintenance and redesign would be necessary to accommodate all-weather traffic.

The transportation plans of local and regional governments are focusing on the need for increased maintenance and improvement of roadways. New Mexico 371 is presently being redesigned and paved to accomodate existing traffic. All except a 20-mile segment between the Bisti Badlands and Crownpoint, New Mexico has been completed. Trucks haul coal on NM 371 from the existing De-na-zin (state lease) Mine, approximately 35 miles south of Farmington, New Mexico, to the San Juan Powerplant located west of Farmington. Of this segment, only approximately 5 miles have not yet been completed.

Increasing traffic and exceeded vehicle design capacities on northern New Mexico Highways have resulted in higher accident numbers and rates. Table 2-12 shows shows the number of traffic accidents and accident rates by highway segment for 1980.

Rail Lines

Two proposed railroads and the existing Atchison-Topeka and Santa Fe (AT&SF) Railroad cross the EIS Region. The AT&SF runs east-west through Gallup, New Mexico, located in the southern portion of the region. An existing spur line of the AT&SF runs in close proximity to the Gamerco and Samson Lake Tracts, providing a mode of coal transport. The railroads proposed to cross the PRLAs and competitive lease tracts are listed in Appendices E-4 and E-5.

The proposed route of the Star Lake Railroad runs within approximately 2 to 10 miles of all but two of the PRLAs. Coal haul trucks would use newly constructed coal haul roads or reconstructed existing bladed roads to access loadout facilities on the Star Lake Railroad.

SOCIAL AND ECONOMIC FACTORS

The EIS Region is characterized by a tri-ethnic culture--American Indian, Hispanic, and Anglo (refer to Table 2-13). This mix of cultures results in regional cities and communities that differ greatly from each other and contain internal variations as well. Differences exist in social and community organization, lifestyles, religious values, and other ethnic and racial precepts.

Demography

The EIS Region's population is centered around less than a dozen cities or towns, and most of the rural area is sparsely settled. In 1980, the region's population density was 11.5 persons per square mile, compared to 10.7 for the State of New Mexico and 62.6 for the United States.

The region's population increased by more than 185 percent between 1950 and 1980, although some counties and cities showed population decreases in the 1960s. In 1950, the region was home for 11.8 percent of the state's population. By 1980, this percentage was 17.8, indicating more rapid growth in the region than in other areas of the state.

TABLE 2-12

TRAFFIC ACCIDENTS AND ACCIDENT RATES BY ROAD SEGMENT
1980

Interstate or State Highway	Segment	Number of Accidents	Accident Rate [a/]
NM 371	Jct. I-40 (Thoreau) Farmington	72	2.0
NM 57	Jct. 44 (Blanco T.P.) - 371	0	0
NM 32	Jct. US 60 (Quemado) - Gallup	47	1.4
NM 197	Jct. 44 (Cuba) - Torreon	17	3.8
NM 44	Jct. 25 (E of Bernalillo) - Jct. 55		
I-40	Jct. 57 (Thoreau) - Az. Line	243	Not avail.
	Entire New Mexico Segment	1566	0.7
NM 53/344	Milan - San Mateo	23	1.1
NM 509	Jct. 53/334 - Ambrosia Lake	5	0.5
NM 170	Farmington-Colorado State Line	20	2.1

Source: New Mexico State Highway Department 1980.

Note: [a/] Accident rate shown is per million vehicle mile.

TABLE 2-13

ETHNIC MIX OF COMMUNITIES AND COUNTIES OF THE EIS REGION (1980 Figures)

County Communities	American Indian [a]/		White (Includes Hispanics)		White (Hispanics Only)		Black		Asian [b]/		Other	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
McKinley County	36,155	65.8	14,071	25.6	7,500	13.6	313	.6	203	.4	4,208	7.7
Crownpoint Division	9,263	87.9	1,121	10.6	217	2.1	16	.2	4	.04	137	1.3
Gallup City	3,557	19.6	10,511	57.9	6,610	36.4	259	1.4	180	1.0	3,654	20.1
Sandoval County	9,499	27.3	20,521	59.1	9,580	27.5	300	.9	65	.2	4,414	12.7
Cuba Division	1,895	48.9	1,264	32.6	1,403	36.2	18	.5	3	.1	697	18.1
Cuba Village	53	8.7	327	53.7	429	70.4	-	-	1	.2	228	37.4
San Juan County	26,777	33.1	48,872	60.5	9,551	11.8	321	.4	153	.2	4,710	5.8
Aztec Division	567	5	9,955	87.7	1,698	15	21	.2	13	.1	794	7
Bloomfield Division	1,049	11.3	7,139	77.2	2,541	27.5	5	.1	6	.1	1,047	11.3
Farmington Division	3,774	10	30,905	81.6	5,172	13.7	268	.7	119	.3	2,807	74
Farmington City	2,626	8.5	25,284	82.3	4,429	14.4	245	.8	104	.3	2,470	8.0
Valencia County [c]/	8,368	13.8	43,334	71.2	26,857	44.1	343	.6	140	.2	8,668	14.2
Grants Division	2,909	11.9	17,703	72.4	10,627	43.5	156	.6	59	.2	3,608	14.8
Grants City	215	1.9	9,322	81.4	5,908	51.6	72	.6	39	.3	1,803	15.7
Milan Village	151	4.0	3,034	81.0	1,770	47.2	70	1.9	10	.3	482	12.9

Source: U.S. Department of Commerce 1981.

Notes: [a]/ Also includes Eskimo and Aleut.
[b]/ Also includes Pacific Islander.
[c]/ Includes what is now Cibola County.

This overall rapid growth has resulted from energy-associated development. Population projections show the growth in the four counties included in the EIS Region continuing through the year 2000. Substantial population growth is projected even for some of the small communities within the region. This rapid growth contributed to each of the counties in the region being designated as energy-impacted counties under Section 601 of the Powerplant and Industrial Fuels Use Act of 1978.

Some counties and communities have specific growth problems that do not follow the regional pattern. For example, nearly all of McKinley and San Juan Counties have been influenced by energy-related activity in the region, while only Cuba in Sandoval County and the Grants-Milan area of Cibola (Valencia) County feel these direct influences.

The population of the village of Cuba in 1980 was 605 people a growth of 47 percent since 1970. However, within the 3-mile planning perimeter, there were about 1,110 people (Middle Rio Grande Council of Governments, 1980). The Grants-Milan area of Valencia (now Cibola) County had a population of 15,198 in 1980, a growth of 38 percent since 1970. This area is made up of two separate cities adjoining one another. Each city struggled to meet the needs of the expanding population in the 1970's, but reduced demand in the uranium industry in the 1980's has caused somewhat depressed economic conditions. Milan, the smaller of the two communities, had a 68 percent population increase in the 1970's, but is currently looking for some industry to replace the jobs lost in the uranium production slowdown.

Housing

The housing supply has nearly doubled in the last decade in the four-county area affected by mining in the EIS Region. The housing supply in San Juan and McKinley Counties from the 1980 census stood at 28,380 and 17,059 respectively. Woodward-Clyde Associates, Inc. estimated that, in 1981, 46 percent of this supply was in areas most likely to be affected by coal mining. In 1980, Valencia and Sandoval Counties had housing supplies of 21,862 and 11,898 respectively (refer to Table 2-14).

The type of housing has changed notably during this ten-year period. The proportion of mobile homes in the four-county area was 9.5 percent of all homes in 1970, and 18.6 percent in 1981. The percent increase annually by county for mobile homes was: McKinley County, 15.5 percent; Sandoval County, 37.9 percent; San Juan County, 29.1 percent; and Valencia County, 26.9 percent. Multi-family home numbers also increased, going from 9.2 percent of all homes in 1970 to 12.3 percent in 1981 in the four counties. Single-family homes decreased from 80.3 percent of all homes to 66.7 percent (four-county total) during this same period.

The housing vacancy rates for the EIS Region are listed in Table 2-15. It is estimated that 6,000 of these homes (17 percent) are in the area likely to be affected by coal leasing.

Water Supply

Data available indicates that most communities have water rights adequate for their present needs. Notable exceptions to this appear to be the

TABLE 2-14

HOUSING SUPPLY SUMMARY
NUMBER OF HOMES BY TYPE
(1970 - 1980)

	McKinley		Sandoval		San Juan		Valencia		Four-County Area	
	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
Total Yearround Housing Units	10,506	17,059	4,602	11,898	14,746	28,380	11,363	21,862	41,217	79,199
Single Family Units	8,302	11,430	4,205	9,751	11,513	17,292	9,341	14,167	33,361	52,604
Multiple Family Units	1,428	2,930	158	948	1,636	4,095	634	2,200	3,856	10,173
Mobile Family Units	776	2,699	239	1,235	1,597	6,993	1,388	5,495	4,000	16,422

Source: University of New Mexico, Bureau of Business and Economic Research, 1982, and New Mexico State Automatic Data Processing Department, 1982

TABLE 2-15
HOUSING VACANCY RATES FOR THE EIS REGION a/

County	Total Number of Units	Number Vacancy	Percent
McKinley	18,128	1,981	10.9
Sandoval	12,286	1,434	11.7
San Juan	29,730	3,360	11.3
Cibola b/	3,977	456	8.7

Source: University of New Mexico, Bureau of Business and Economic Research, 1982.

Notes: a/ These are 1980 figures. The numbers are probably higher now due to the slump in oil and gas and uranium activity.
b/ These figures are for the city of Grants only.

cities of Aztec and Bloomfield, where annual rights are shown as 1,178 and 400 acre-feet, respectively, and use is shown at 1,188 and 1,100 acre-feet, respectively (refer to Tables 2-16 and 2-17). While the figures for Gallup do not show any shortage in water rights, Gallup has had concerns over an adequate water supply for its projected growth and has gone to great expense to find adequate water for its needs. Several community and individual water systems exist throughout the EIS Region.

Wastewater Systems

Figures available indicate that Farmington, Aztec, and Crownpoint are each operating their wastewater treatment facilities at capacity. Figures for other communities show used capacity ranging from 33 to 60 percent. In addition to unused capacity, plant modification could add capacity to the Farmington and Aztec systems. Farmington has also indicated a need for sewerline replacement.

In rural areas, many homes are served by individual septic systems.

AMERICAN INDIAN CONCERNS

Indian Tribes in the EIS Region

The EIS Region is located within the State of New Mexico's newly created 3rd Congressional District. This district contains nearly all of the state's 110,000 American Indians, including 41 chapters of the Navajo Nation, the Jicarilla Apache Reservation, and 19 pueblos (Steinberg, 1982). Approximately one-half the population of the state's San Juan and McKinley Counties, where the competitive coal lease tracts are located, is made up of American Indians, principally Navajo (Woodward-Clyde, 1982).

The Zuni Reservation and the Ute Mountain Ute Reservation are adjacent to competitive coal lease tracts on the extreme northern and southern portions of the EIS Region. The BLM has made initial contact to notify these tribes of potential leasing in the area.

The Navajo Tribe

All of the proposed EIS Region, with the exception of the four La Plata tracts north of Farmington, lies within the Eastern Navajo Agency. This agency is an off-reservation administrative unit of the Bureau of Indian Affairs (BIA)/Navajo Nation. The agency had an estimated 1980 Navajo population of 35,407 (USDI, BIA 1982). This population is subdivided among chapters and districts, the basic political units of Navajo Tribal Government.

Seventeen chapters within Districts 15, 16, and 19 are located within PRLAs or competitive lease tracts. The names of these chapters and their estimated 1980 Navajo population are shown in Table 2-18. Agency, district and chapter boundaries are shown on Visual D.

Navajos Living on the PRLA Area

As shown in Appendix F-1, Navajos live on six of the PRLAs proposed for surface mining and one PRLA proposed for underground mining. Of the 18 residence groups living on the PRLAs, 7 are located on public lands, 1 is on a

TABLE 2-16

COMMUNITY WATER SYSTEMS

	Farmington	Aztec	Bloomfield
Source	Animas and San Juan Rivers	Animas River	San Juan River
Annual Rights (acre-feet)	18,103	1,178	400
Treatment Capacity			
Annual (acre-feet/yr.)	44,809	1,608	1,680
Daily (Gallons/day)	40,000,000	1,500,000	1,500,000
Storage Capacity			
Raw (acre-feet/yr.)	7,620	31	80
Treated (Gallons/day)	16,500,000	3,250,000	750,000
Use			
Annual Withdrawal (acre-feet/yr.)	14,179	1,188	1,100 a/
Peak Day (Gallons/day)	23,000,000	2,100,000 a/	2,000,000

Source: Woodward-Clyde Consultants, 1982; New Mexico State Engineers Office, 1982; New Mexico State Planning Division,1982; New Mexico State Economic Planning Division, 1982; and Cuba Engineers Office, 1982.

Note: a/ Estimated.

TABLE 2-17

COMMUNITY WATER SYSTEMS
(Wells)

Source	Gallup	Crownpoint	Thoreau	Grants-Milan	Cuba
Annual Rights (acre-feet)	847 Permitted 10,645 Declared	a/	200 Afy	2,990	Not allowed at present
Treatment Capacity					
Annual (acre-feet)	4,201	973	205	7,706	600
Daily (Gallons/day)	3,750,000	868,320	208,800	6,695,000	535,568
Sewage Capacity Type	Primary-secondary	4-Cell lagoons	Lagoon	Activated slush plant	2-Cell lagoons w/sand filter
Capacity (1980) (Gallons/day)	2,500,000	a/	a/	2,000,000	120,000
Use as a % of Capacity	44%	100%	33%	50%	60%
Use					
Annual Withdrawal (Acre-feet)	2,738	900	120	2,987	358
Peak Day (Gallons/day)	2,500,000	800,000 Est.	a/	4,800,000	a/

Source: Woodward-Clyde Consultants, 1982; New Mexico State Engineers Office, 1982; New Mexico State Planning Division, 1982; New Mexico State Economic Planning Division, 1982; and Cuba Engineers Office, 1982.

Note: a/ Figures not available.

TABLE 2-18

POPULATION OF NAVAJO CHAPTERS
PRINCIPALLY AFFECTED BY PROPOSED LEASING
(1980 Population Estimates)

District Chapter		Estimated Population
District 15		
Becenti		615
Crownpoint		1,609
Lake Valley		648
Little Water		912
Pueblo Pintado		1,169
Torreon		1,668
Whitehorse Lake		968
White Rock		399
	SUBTOTAL	7,988
District 16		
Bread Springs		1,046
Chi-Chil-Tah		2,180
Church Rock		2,563
Red Rock		1,808
Tsayatoh		889
	SUBTOTAL	8,486
District 19		
Counselor		1,117
Huerfano		2,368
Nageezi		1,341
Ojo Encino		772
	SUBTOTAL	5,598
	TOTAL	22,072

Source: USDI, BIA 1982

homestead, 7 are on Indian allotments, 1 is on surface withdrawn for Indian use under Public Land Order (P.L.O.) 2198, and 2 are on surface owned by the Navajo Tribe. (Refer to the Glossary for definitions of these forms of ownership.)

Surface ownership in the Eastern Navajo Agency is typically in a patchwork pattern. Families not authorized to live on public domain lands occur throughout the area administered by the Eastern Navajo Agency. In many cases, these are families who have been living in the same location for two to three generations or longer. Serious land management problems have developed as a result of the occupancies and the complex ownership pattern. The most recent effort to resolve some of the problems is a proposed land exchange between the U.S. Government and the Navajo Tribe (refer to the land use section of this chapter). Some unauthorized Navajo families located on the competitive lease tracts are included in this proposed exchange.

Seven Navajo residence groups not authorized by the BLM are living on public land. They are excluded from the above exchange because the PRLAs are pre-existing lease applications for federal coal.

The 39 households on the PRLAs represent separate nuclear families. Based on an average nuclear family size of 5.8 members (Arthur, 1978), these nuclear family households could include 226 individuals. Many Navajos feel strong emotional ties for a household associated with a residence group living in a particular geographic locale. It is known that adults working elsewhere regard the households/residence groups on the PRLAs as their real home and return as frequently as possible.

A total of 55 residences occur on the PRLAs. One-third of the households own two or more residences. This quantity of housing may reflect the fluctuating household requirements for sheltering returning family members. The variety of building styles appears to reflect specialized ceremonial requirements. One-third of all residence groups have at least one hogan, a building essential for the performance of curing ceremonies.

Approximately 10 percent of the residences have piped water, but domestic water must be hauled to the remaining residences. Many families travel several miles to the nearest source of water, usually a BLM, BIA or Navajo Tribe well. Approximately 53 percent of the Navajos in the Shiprock Agency haul water (Arthur, 1978). This situation is also assumed to occur on the proposed competitive lease area outside the PRLAs.

Navajos Living on the Competitive Tracts

Families on the competitive coal lease tracts were inventoried by BLM personnel flying parallel transects by helicopter across each tract. A total of 345 residences were recorded on surface mineable tracts and 110 residences on underground mineable tracts. Surface ownership and legal descriptions of these residences are shown in Appendices F-2 and F-3. Visual D shows the number of residences per tract, along with the number of residences and households on the PRLAs. It is assumed that clusters of residences on the tracts probably reflect residence groups, but this has not been confirmed by field interviews. (As is evident from the discussion of families on the PRLAs, the number of residences is not necessarily an accurate measure of the number of households that may be present.)

Social and Economic Patterns

It is estimated by BLM personnel that approximately 65 percent of fulltime Navajo residents on the PRLAs and competitive lease tracts are non-English speaking. While there is known to be considerable variation in social and economic behaviors from one family to another, traditional social and economic patterns generally remain strong among rural Navajos throughout the area surrounding the EIS Region. The following discussion relates to social and economic patterns known to prevail on the PRLAs and believed to be typical of all or the majority on the competitive coal lease tracts.

Livestock grazing is the principal economic activity on the PRLAs. It is estimated by the BLM to account for approximately 30 percent of the average income. Ninety-four percent of the residence groups have access to one or more grazing permit(s). As shown in Appendix F-1, corrals, barns and other livestock facilities are shared by the households within residence groups. It is projected that extensive pooling of labor, money, and personally owned property such as vehicles also occurs between full-time and part-time residents.

Livestock grazing in the Eastern Navajo Agency is administered under a 1968 Cooperative Agreement between the Navajo Tribe, the BIA, and the BLM. Under the terms of the 1978 revision to this agreement, the majority of the grazing on the competitive coal lease tracts is administered by the BIA-Navajo Tribe. Seventy-seven percent of the livestock permits held by occupants on the PRLAs are BIA-Tribal permits.

Grazing permits are valued property, and permits relinquished through death are transferred within families whenever possible. Demand for grazing use areas exceeds the available permits. Conflicts over grazing boundaries between use areas are common.

The Navajo Tribe has selected 35,000 acres of public land in New Mexico under the provisions of the Navajo and Hopi Settlement Act (P.L. 93-531, as amended by P.L. 96-305 (refer to Chapter 1, the section entitled "Interrelationships With Other Projects in the Region"). The Department of the Interior has this selection under active consideration but has not decided to approve it. Because of the interest shown in lands in the Bisti/De-na-zin area, it is anticipated that an unknown number of Navajo families from the former Navajo-Hopi Joint Use Area in Arizona will be resettled on lands selected by the Navajo Tribe on or around the competitive coal lease tracts. Any additional settlement may increase the existing demand for grazing use areas and the number of conflicts over grazing boundaries.

The location of water is a critical factor in the management of livestock operations within use areas. The number of natural springs is limited. Deep wells provide the major source of livestock water, with some seasonal water available from earthen tanks and shallow wells dug into washes. When water is available, livestock operators with sufficiently large use areas rotate their stock among seasonal pastures. Some livestock operators make use of seasonal residences in conjunction with range rotation, still another factor accounting for the number of residences per household.

Sheep and goats are a traditional source of cash income, and these animals remain important in the economics of some families.

Rug weaving is also an important source of supplemental income for some families in the EIS Region. Handcrafts are particularly important during periods of economic adversity such as the present, when Navajo unemployment has reached a reported rate of more than 75 percent (Albuquerque Journal, 1982). While the income realized per hour of labor is notably low for weavers, supplies of locally produced wool are available at a nominal cost. A variety of minerals and plants are gathered by weavers, including gypsum (used to remove grease from white wool), yucca (used as a cleaning agent), and such plants as snakeweed, serviceberry and Mormon tea (used as natural dyes).

Gravesites

Archaeological evidence indicates that the Navajos have been living continuously in the EIS Region for the past two to three centuries. The earliest presently known Navajo site on a competitive lease tract has been dated to the Developmental Herding Period (A.D. 1696-1800). The majority of Navajo occupation sites in the region date from the Post-Bosque Redondo Period (A.D. 1868), with the greatest amount of settlement occurring in the present century. Due to the length of time the Navajo have occupied the EIS Region, substantial numbers of gravesites may be present (refer to USDI, BLM, 1981a and 1981b for a discussion of Navajo burial practices).

Some gravesite locations have been identified to the BLM. As shown in Appendix F-4, 6 graves have been identified on surface mineable PRLAs, 5 graves on underground mineable PRLAs, and 25 to 35 graves on surface mineable competitive lease tracts. The locations and numbers of these graves have not been confirmed by the BLM. The precise location of Navajo graves is often difficult to determine, but the general locations of most burials from the past one to three generations could probably be identified through systematic personal interviews supplemented by visible archaeological evidence.

Sacred Sites

According to data collected by the Shiprock Research Center in 1975, 47 percent of Navajos report a religious affiliation with the traditional Navajo religion. Others are affiliated with the American Indian Church (Woodward-Clyde, 1982). Plants and minerals gathered from prescribed locations are essential to the ceremonial practices of both these groups. No systematic effort has been made by the BLM to identify all gathering areas in the EIS Region, but two gathering areas have been identified on surface mineable competitive coal lease tracts (refer to Appendix F-5).

Four offering points have been identified on surface mineable PRLAs, a possible offering point associated with water on a surface mineable competitive lease tract, and a sacred site of unknown type on an underground mineable competitive lease tract.

Additional sites of various types may exist. Several medicine men have informed the BLM that they consider the entire area between the four sacred mountains of the Navajo to be holy land.

Surface Water

Data about surface water on the individual coal tracts do not exist; however, site-specific information is required as part of the mining and reclamation plan that the applicant submits to the Office of Surface Mining and the New Mexico Coal Surface Mining Commission. The following section is a general description of surface water in the EIS Region.

The EIS Region lies within both the Rio Grande and Colorado River drainage basins. The coal tracts east of the Continental Divide (Rio Grande basin) drain to Arroyo Chico. Most of the tracts lie west of the Divide in the Colorado River basin. The La Plata tracts and those in the Chaco River basin drain to the San Juan River; the tracts near Gallup are in the Puerco River watershed, except for the small part of the Pinehaven tract that is in the Zuni River drainage. The location of the coal tracts in relation to the major drainage basins is shown in Figure 2-A.

Surface-water quantity

The limited quantity and erratic temporal and spacial distribution of precipitation causes streamflow to be extremely variable. Approximately one half of the annual precipitation occurs from July through October, generally in the form of localized, short-duration, high-intensity thunderstorms. These storms may create large flows, which are commonly of limited duration and areal extent. Winter precipitation produces longer, lower volume flows. Precipitation is summarized in Appendix Figure B-1.

The San Juan and the Animas Rivers are the only perennial streams in the area; both derive much of their flow from snowmelt in the San Juan Mountains in Colorado. Reaches of Arroyo Chico and the Puerco River have flow caused by uranium-mine dewatering, and the Chaco River near Waterflow generally has flow because of powerplant wastewater effluent. All other streams in the area are either ephemeral (that is, flowing only in direct response to precipitation) or intermittent (flowing only at certain times of the year).

Daily streamflow for the 1981 water year for gaging stations on the Chaco River near Burnham and on Arroyo Chico near Guadalupe is shown in Figure 2-B. The variability in day-to-day flow and the sharp increases in flow caused by precipitation are typical of streams in the EIS Region.

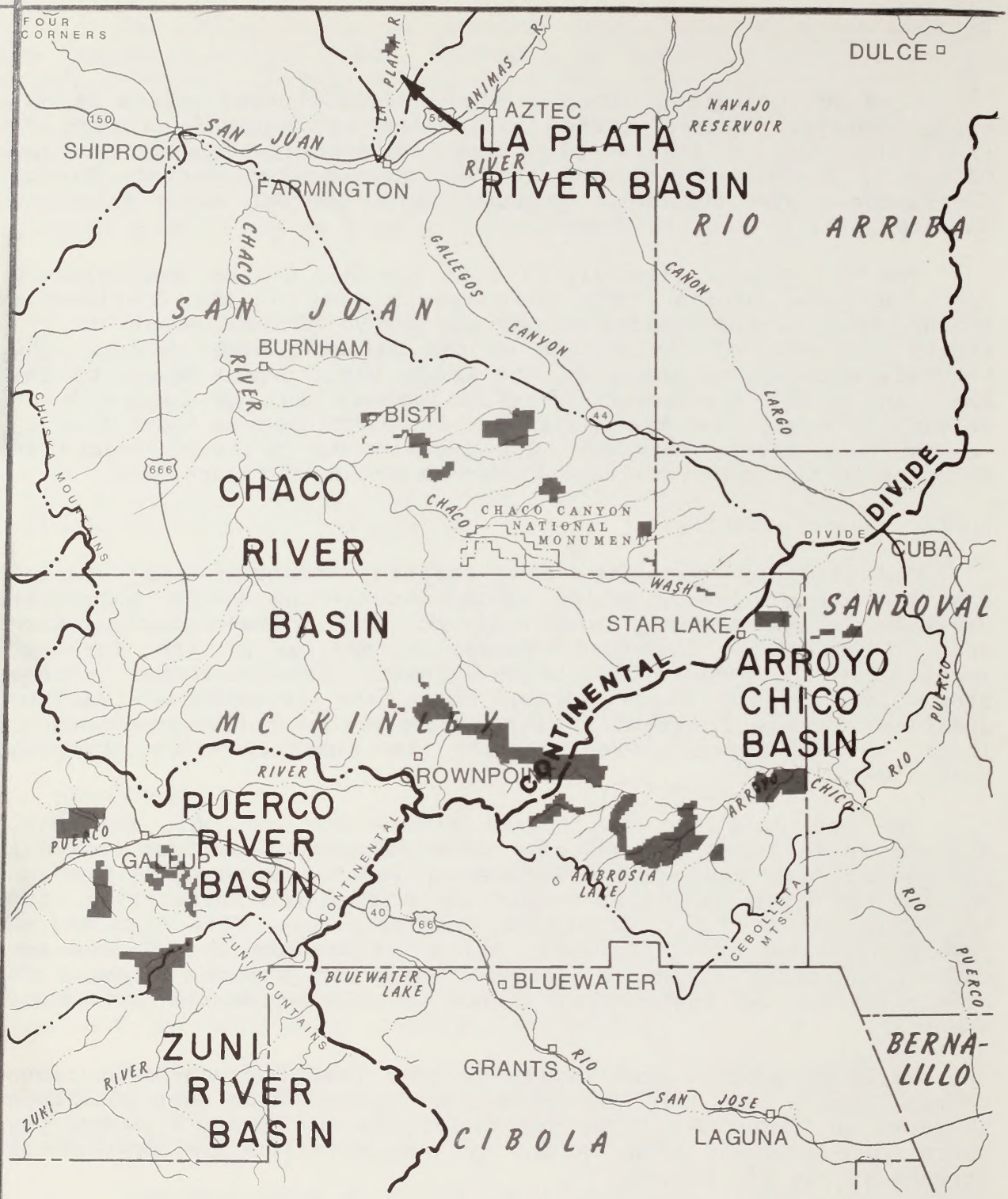
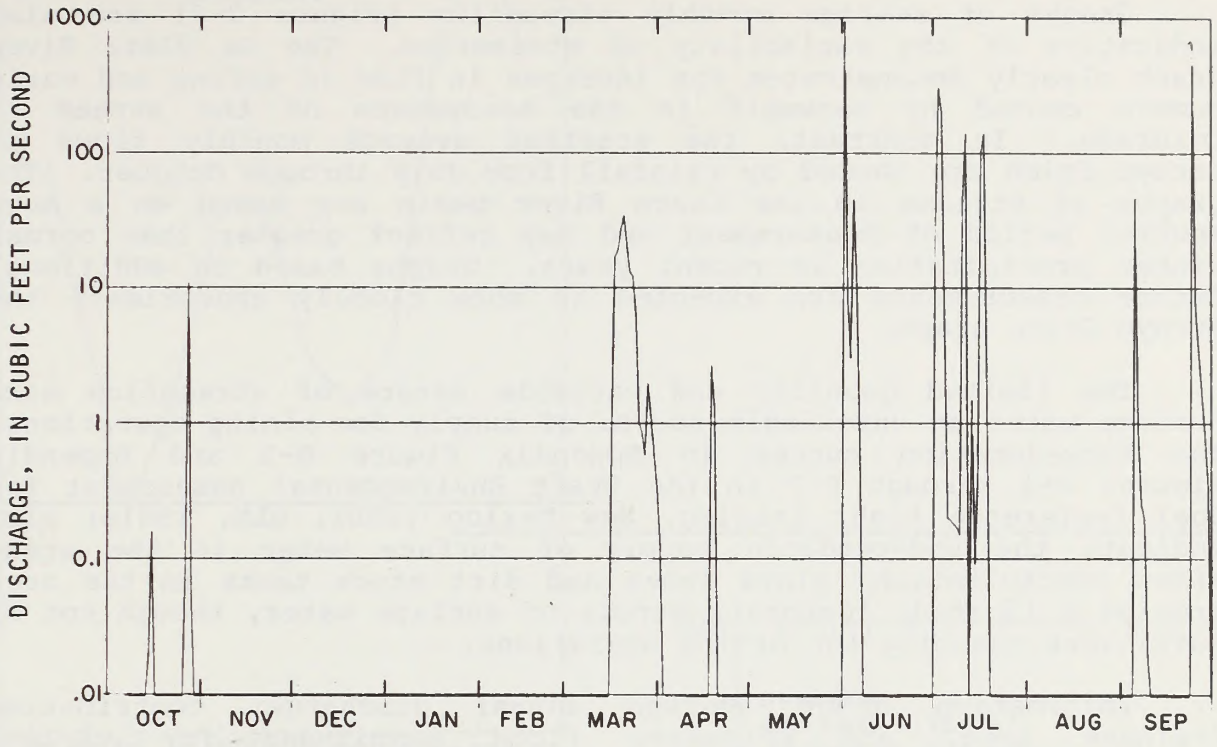
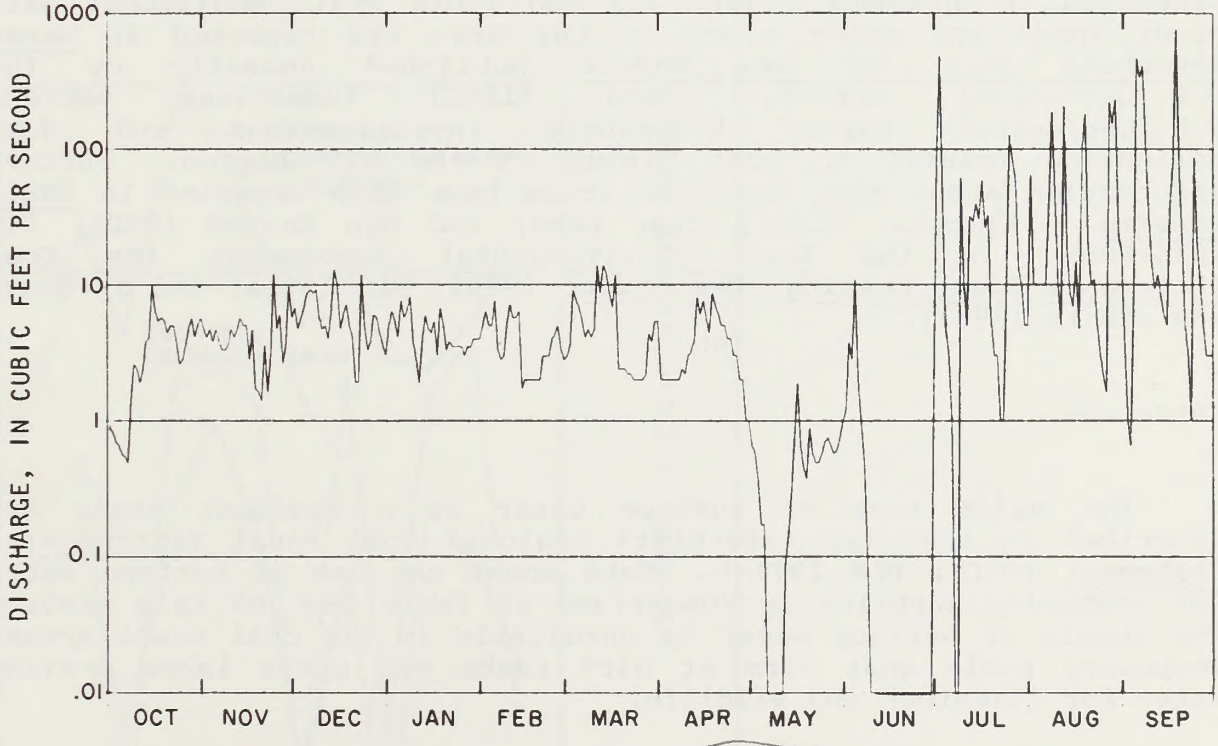


Figure 2-A. Location of coal tracts in relation to major drainage basins.



09367938 Chaco River near Burnham, New Mexico



98340500 Arroyo Chico near Guadalupe, New Mexico

Figure 2-B. Daily streamflow at selected gaging stations, 1981 water year.

← WHERE?

Graphs of average monthly streamflow (Figure 2-C) are also indicative of the variability of streamflow. The La Plata River graph clearly demonstrates the increase in flow in spring and early summer caused by snowmelt in the headwaters of the stream in Colorado. In contrast, the greatest average monthly flows in Arroyo Chico are caused by rainfall from July through October. The graphs of streams in the Chaco River basin are based on a much shorter period of measurement and may reflect greater than normal winter precipitation in recent years. Graphs based on additional future measurements are expected to more closely approximate the Arroyo Chico graph.

The limited quantity and variable nature of streamflow make surface water an unreliable source of supply for mining operations. The flow-duration curves in Appendix Figure B-2 and Appendix Figures F-1 through F-7 in the Draft Environmental Assessment for Coal Preference Right Leasing, New Mexico (USDI, BLM, 1981a) also indicate the undependable supply of surface water in the area. After precipitation, playa lakes and dirt stock tanks in the area provide a limited, temporary supply of surface water, though not of sufficient quantity for mining operations.

Information about average annual discharge, contributing drainage area, and estimated flood magnitudes for various recurrence intervals for selected sites in the EIS Region are presented in Appendix Figure B-3 and Table B-4. Additional data about these and other sites in the area are reported in Water Resources Data for New Mexico published annually by the U.S. Geological Survey. Hejl (1982) summarizes current U.S. Geological Survey hydrologic investigations and data collection related to coal mining in the EIS Region. Further information about more specific areas have been reported in EMRIA Reports - Kimbeto, Bisti, Star Lake, and Ojo Encino (USDI, BLM 1976-80b), in the Draft Environmental Assessment for Coal Preference Right Leasing, New Mexico (USDI, BLM 1981a) and by Shown and others (1981).

Water use

The major uses of surface water on a regional basis are described in the Star Lake-Bisti Regional Coal Final Evironmental Statement (USDI, BLM 1979c). Data about the use of surface water for community supplies is summarized on Table 2-16 of this report. The supply of surface water is unreliable in the coal tract areas. Temporary pools that form at dirt tanks and playa lakes provide water for livestock and wildlife.

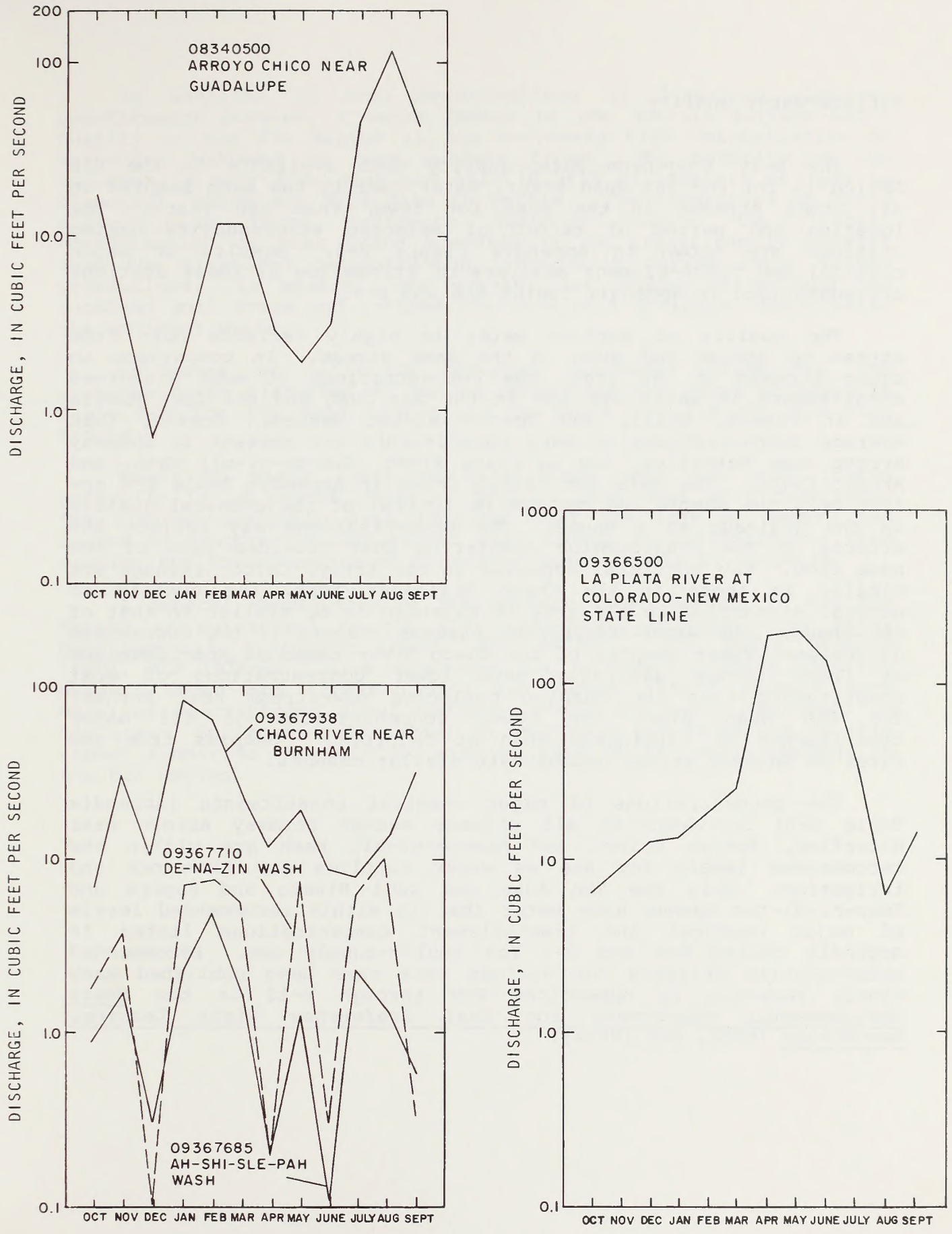


Figure 2-C Average monthly streamflow at selected gaging stations.

Surface-water quality

The only long-term water-quality data available in the EIS Region is for the San Juan River; water quality has been sampled on all other streams in the area for fewer than ten years. The location and period of record of selected water-quality gaging stations are shown in Appendix Figure B-5. Results of major chemical and trace-element analyses of streamflow at these stations are summarized in Appendix Tables B-6 and B-7.

The quality of surface water is highly variable both from stream to stream and even in the same stream. In comparison to other streams in the area, the concentrations of most dissolved constituents in water are low in the San Juan and the Zuni Rivers and in Papers, Gallo, and Teec-ni-di-tso Washes. Greater than average concentrations of many constituents are present in Shumway Arroyo near Waterflow, the La Plata River, Kim-me-ni-oli Wash, and Arroyo Chico. The data for Arroyo Chico in Appendix Table B-6 are from only one sample and may not be typical of the chemical quality in the drainage as a whole. The concentrations may reflect the effects of the uranium-mine dewatering that provides much of the base flow. The surficial deposits in the Arroyo Chico drainage are similar to those in the Chaco drainage; thus, the quality of natural streamflow in the area is expected to be similar to that of the Chaco. The water quality of streams changes in the downstream direction. Water samples of the Chaco River taken at Star Lake and at Chaco Canyon generally have lower concentrations of most constituents than the samples collected downstream near Burham. The San Juan River has lower concentrations of all major constituents at Farmington than at Shiprock. Samples from two sites on Shumway Arroyo demonstrate similar changes.

The concentrations of major chemical constituents (Appendix Table B-6) in water in all streams except Shumway Arroyo near Waterflow, Arroyo Chico, and Kim-me-ni-oli Wash are within the recommended levels for use as water supplies for livestock and irrigation. Only the San Juan and Zuni Rivers and Papers and Teec-ni-di-tso Washes have water that is within recommended levels of major chemical and trace-element concentrations listed in Appendix Tables B-6 and B-7 for public-supply use. Recommended water-quality criteria for various uses have been published many times, recently in Appendices F-9 through F-11 in the Draft Environmental Assessment for Coal Preference Right Leasing, New Mexico (USDI, BLM 1981a).

In addition to the concentrations of dissolved chemical constituents present, a major factor in the overall surface-water quality in the EIS Region is the extremely high concentration of suspended sediment in most surface flows. The majority of the sediment is very fine clay and silt (0.0625 millimeters or less in diameter), which are very slow to settle. The adsorption of trace elements on these sediments commonly causes the "total" concentration of most trace elements to be significantly greater than the dissolved concentration, especially during large volume streamflows. In general, the greater the amount of badland and rockland soil areas and incised channels in a drainage, the greater the sediment yield.

Estimates of naturally occuring sediment yields for the acreages to be disturbed by mining operations are shown in Appendix Table B-8 for the PRLA tracts and in Table B-9 for the EIS coal tracts.

Water in playa lakes or dirt tanks near the coal tracts generally is of poorer chemical quality than that of streamflows. The limited available data indicate that the rate of water loss caused by evaporation may exceed that caused by infiltration; thus causing the concentration of dissolved constituents to increase.

A general description of the surface-water quality in the EIS Region is summarized in the Star Lake-Bisti Regional Coal Final Environmental Statement (USDI, BLM 1979c). The EMRIA Reports (USDI, BLM 1976-80) give water-quality information about specific areas. Shown and others (1981) and Summer (1981) present very detailed descriptions about sediment yield for small drainages in the area. Reclamation Potential in Chapter 2 and Table 2-6 in this report summarize the relative erosion rate of the soils present in the EIS Region.

CHAPTER 3
ENVIRONMENTAL CONSEQUENCES

CHAPTER 3

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter addresses the impacts that would result from coal mining on 39 competitively leased tracts in the New Mexico portion of the San Juan River Coal Region. These tracts have been grouped into four production tonnage levels (128.5 million, 916.0 million, 1.32 billion, and 1.94 billion tons) in order to facilitate impact analysis. Each tonnage level is associated with one of the alternatives described in Chapter 1.

This impact analysis deals only with the cumulative significant impacts resulting from the construction of facilities and the mining of federal coal. The site-specific impacts of these activities on each tract will be analyzed in more detail in environmental documents prepared by the New Mexico Energy and Minerals Department and the Office of Surface Mining (OSM) when each mine plan is submitted.

ANALYSIS FRAMEWORK

General

The consequences of developing all of the coal reserves (federal and private) within a tract are analyzed. On some tracts, the amount of federal coal reserves is nearly negligible, and these tracts will likely be mined for their private reserves even if the federal reserves are not leased. Therefore, this EIS analyzes the impacts of mining these entire tracts, though most of their reserves are non-federal.

The impacts discussed in this chapter may begin to occur earlier than indicated in the text and tables; however, it is believed that accumulations of impacts over time would remain the same, as would annual impacts beyond 1993.

Coal mining unsuitability criteria have been applied. In those areas of the tracts where resource information is not available, special stipulations requiring inventories and protection of the resource(s) will be attached to the lease. Mitigating measures and stipulations will be applied, as needed, upon completion of inventories. Refer to Table 1-5 for a listing of those lands that have been dropped from further consideration because of the application of the unsuitability criteria.

Chapter sections discussing mitigating measures, unavoidable adverse impacts, short-term use versus long-term productivity (except for non-renewable resource components), and irreversible and irretrievable commitments of resources are located after the analysis of the impacts under the High Alternative.

ASSUMPTIONS AND ANALYSIS GUIDELINES--NO ACTION ALTERNATIVE (PRLAs)

These assumptions were developed based on material submitted by the applicants to meet the initial showing requirement, subsequent coordination with and confirmation by the applicants, and close consultation with the Minerals Management Service

1. The Star Lake Railroad, including spurs and loops, would be available to transport the coal by 1987.

2. Power would be delivered by the Fruitland Coal Load Transmission Line.

3. There would be zero discharge from point sources to waterways at support facility sites.

4. Haul roads, utility easements, and other associated facilities would undergo impact analysis as rights-of-way applications are received. It would not be until applications were submitted that the specific locations, alignment and other right-of-way information would be developed by applicants meeting the final showing requirements.

5. Production would begin within 10 years of the issuance of a lease and would meet statutory and regulatory minimums.

8. Post-mining land uses would, in general, include the present land uses of livestock grazing, wildlife habitat, and recreation.

The federal coal under the PRLAs is combined into logical mining units with state and private coal.

Under the No Action Alternative the impacts of mining on the PRLAs are analyzed for air quality, land uses, and American Indian Concerns. Impact analysis for soils, water resources, livestock grazing, and cultural resources on the PRLAs can be found in the Final Environmental Assessment for Coal Preference Right Leasing, New Mexico (the "PRLA EA"--USDI, BLM 1981b. These impacts are summarized in Table 1-7 in Chapter 1 of this EIS. Analysis in addition to that done in the PRLA EA is conducted in this EIS for paleontology, wildlife, visual resources, wilderness, recreation, transportation, and social and economic factors. Cumulative impacts, where applicable, are considered for mining on the PRLAs and the following developments located on or adjacent to the competitive coal lease tracts: the Animas-La Plata Irrigation Project, Star Lake Railroad, Continental Divide Pipeline, Fruitland Coal Load Transmission Line, Mentmore Mine, and Lee Ranch Mine.

ASSUMPTIONS -- BYPASS THROUGH HIGH LEVEL ALTERNATIVES

The assumptions used for impact analysis in this EIS for the Bypass, Minimum Surface Owner Conflicts, Target, and High Level Alternatives are enumerated by resource component below. The assumptions for the No Action Alternative were also used for impact analysis in the remaining alternatives.

General

1. The analysis for each alternative assumes that all tracts would be leased and developed, even though what may realistically be expected to occur may fall short of this in any given alternative.

2. For all coal leased in the San Juan River Coal Region, it is assumed that markets will be available in and outside the region. This may not be the case, but it has been considered as such for a worst-case analysis.

3. On the average, start-up of construction and production on the competitive lease tracts will occur in 1986 and 1987 respectively. Approximately 50 percent of the 39 tracts would start production and mine a total of 7.25 million tons in 1987. Peak production will occur in the year 2000. Significant impacts will begin with actual production. Assuming that leases for the tracts discussed under the various alternatives are issued in 1983, production will begin no later than 1993 as required by the Mineral Leasing Act except for the Hospah #1, Hospah #2, and Gallo Wash #2 tracts.

4. Coal recovery tonnages are based on a 50 percent rate for underground mines and an 85 percent rate for surface mines.

Air Quality

The background air quality value for the EIS Region is assumed to be 30 micrograms per cubic meter (ug/m^3) as recorded at Zuni, New Mexico. The existing mines and facilities are assumed to be part of the present background and are not analyzed separately.

Topogaphy and Mineral Resources

Competitive coal lease tracts in the Bypass Alternative will be developed in conjunction with adjacent existing leases or PRLAs.

Livestock Grazing and Vegetation

Mined lands will not be available for grazing during the entire life of a mine, even though the tract has been revegetated.

Wilderness

Coal lease NM-0186613 and the northern portion of lease NM-0186612 will be exchanged for comparable leases in the Bisti #1 Tract (refer to the Draft Bisti Coal Lease Exchange Environmental Assessment,-- USDI, BLM 1982c).

Recreation

The entire area of surface disturbed by each mine will be closed to public use for the life of the mine.

Transportation

1. The proposed Star Lake Railroad will be constructed and available for transportation of coal by 1987. Trucks will be use to transport coal to loadout facilities on the Star Lake Railroad.

2. State highways will be utilized by commuting workers in car pools, rather than the less direct routes of unimproved county and other agency-maintained roads at a rate of two persons per vehicle.

Social and Economic Factors

1. Increases under 10 percent are not significant and are not included in the EIS.

2. Net taxable values are $2.5 million dollars per million tons of annual production for surface mining, and $8.33 million dollars per million tons of annual production for underground mining.

3. Severance tax (including surtax) is $.73 per ton.

4. Tax rates are in dollars per $1,000 of net taxable value as used in the 1980-81 tax year.

5. For underground and surface mines respectively, 30 and 50 percent of the newly hired work force would be local hires, and 70 and 50 percent would be inmigrants to the region.

IMPACT ANALYSIS

The remainder of this chapter discusses the significant impacts of the alternatives. The discussion first analyzes the impact of an alternative and then the cumulative impacts of mining under this alternative plus the impacts of mining the PRLAs (No Action Alternative).

IMPACTS--NO ACTION ALTERNATIVE

This alternative proposes no new competitive leasing of federal coal. Coal production would result from (1) the development of coal from existing and proposed coal mines under contract commitments or mine plans; and (2) the issuance of federal leases for 26 existing Preference Right Lease Applications (PRLAs). In-place reserves for leased federal coal are approximately 2.2 billion tons, with 1.75 billion tons being recoverable.

Air Quality

Two air quality analyses were performed to provide input for this EIS. The first, by Pedco (1982), was a screening analysis to detemine the air quality impacts of mining on each of the proposed lease tracts. The study first

assessed each tract individually to determine significance of the impacts. A preliminary analysis was then performed to determine the cumulative impacts of proposed mines in close proximity to other mines. Results of the analysis indicated three areas that showed potential problems and needed further analysis.

This further analysis was done by ECOS Management Criteria, Inc. (1982). ECOS used a computerized regional dispersion model to determine ambient concentrations of total suspended particulates (TSP) resulting from coal mining and transportation for each of the alternative levels of mining. Information regarding dispersion models, meteorological data and methodology can be found in Appendix G of this EIS. More detailed data is located in the technical reports done by Pedco and ECOS, copies of which are available in the Farmington Resource Area Office.

The significant pollutant from developing the proposed lease tracts would be TSP. Impacts of other pollutants (sulfur dioxide, nitric oxide, nitrogen dioxide, carbon monoxide, non-methane hydrocarbons, ozone, and lead) would be immeasureable on a regional scale and insignificant. Thus, this analysis of air quality impacts focuses on the impacts related to TSP.

The development of the PRLAs is estimated to result in the emission of 3,542 tons of total suspended particulates (TSP) per year. The resulting 24-hour ground level concentrations of 100 ug/m3 is shown in Table 3-1. The concentration does not exceed any of the New Mexico or federal National Ambient Air Quality Standards (NAAQS) or Prevention of Significant Deterioration (PSD) limitations for either the short term (24-hour) or the long term (annual).

The frequency of occurrence of the 24-hour maximum values could not be determined with this analysis. More realistic 24-hour impacts could be obtained using a short-term model and appropriate 24-hour meteorological data when more detailed mine site information is developed at the mine-plan stage. As seen in Appendix G, the TSP concentrations are limited, in spatial extent beyond the coal lease boundaries), as would be expected of larger particles resulting from mining activities.

A Class I area, the Chaco Culture National Historical Park, was examined to determine if the TSP levels allowable under the PSD regulations would be exceeded. The increased TSP levels would be below the applicable air quality class levels.

Fugitive dust particles suspended in air can cause a reduction in visual range as a result of the scattering of light. An approximate assessment of reduction in visual range from this alternative was made using the approach of Ursenbach (1978). Assuming an annual background concentration of 30 ug/m3, the visual range would be reduced to 67 miles (by 8 percent). Short-term (24-hour) concentrations would result in a reduction of visual range to 32 miles, a decrease of 56 percent.

Using the same analysis for the Chaco Culture National Historical Park, visual range reductions would be 3 percent on an annual basis and 18 percent on a short-term, 24-hour basis. Visual range measurements made at the park by the National Park Service indicate an average visual range of approximately 127 miles. This visual range would be equivalent to a TSP concentration of 7 ug/m3 using Ursenbach's method.

TABLE 3-1

VIOLATION OF TOTAL SUSPENDED PARTICULATES (TSP) BY ALTERNATIVE

Alternative	Total TSP [a]	TSP Violation [b]
No Action	100 ug/m^3	--------
Bypass [a]	163 ug/m^3	13 ug/m^3
Minimum Surface Owner Conflicts [a]	234 ug/m^3	84 ug/m^3
Target [a]	234 ug/m^3	84 ug/m^3
High [a]	236 ug/m^3	86 ug/m^3

Note: [a] Total includes that for the No Action Alternative.
[b] New Mexico State 24-hour standard for TSP is 150 ug/m^3.

TABLE 3-2

TOTAL ACRES DISTURBED BY ALTERNATIVE

Alternative	Surface Disturbed (Acres) 1987	2000	Total	Surface Facilities (Acres)	Total Surface Acres
No Action - Total	10,800	19,300	31,765	705	31,970
PRLAs	1,500	10,000	22,023	705	22,727
Bypass [a]	364	1,342	5,530	600	6,130
Minimum Surface Owner Conflicts [a]	308	4,988	18,252	1,050	19,302
Target [a]	859	10,593	33,877	2,100	35,977
High [a]	1,771	23,641	65,141	3,500	68,641

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

Based on the use of the NAAQS and PSD standards as a measure of significance, the calculated increased TSP concentrations from this alternative would not result in a significant air quality impact.

Topography and Mineral Resources

Surface Mining

Mine-site preparation would involve alteration of the natural topography. However, the mining phase of the operation would have a much greater impact on topography, because the overlying strata would be blasted, removed and stockpiled. The destruction of the topography would result in the most significant impacts to paleontology, livestock grazing, cultural, visual, and wilderness resources. The impacts to these resources are discussed in those sections under this and the Bypass Alternative.

The primary impact on the mineral resource of the EIS Region would be the removal of the coal beds and destruction of the overlying strata by surface mining. Table 3-2 shows that under this alternative, approximately 10,800 and 19,300 acres would be disturbed in 1987 and the year 2000, respectively. A total of 31,970 acres would be disturbed by mining.

Underground Mining

Underground mining would result in the removal of 50 percent of the mineable coal beds. Underlying coal beds would not be disturbed and could be mined at a later date.

A further impact would be the potential destruction of the strata immediately overlying the mined tracts as a result of possible subsidence. Subsidence could occur on an undetermined number of acres and would be determined by several variables, including: (1) mining methods, (2) overburden thickness and type, (3) production rate and seam thickness, and (4) geometry of mine workings (USDI, MMS 1982). Subsidence would be greatest at the center of the mined-out area and much less in the peripheral areas. Surface expressions of subsidence could include open fractures, buckled and bulged bedrock, sinkholes, and other depressions. Subsidence could cause damage to structures or improvements located on underground mine areas.

Construction of mine and transportation facilities would result in the consumption of sand and gravel. The location and amount of these materials in the quarries cannot be approximated at this time.

Exploration for or recovery of oil and gas is currently at a low level. Once coal mining is completed, exploration and recovery of oil and gas could occur.

Paleontology

Implementation of the No Action Alternative would impact paleontological resources of the late Cretaceous Crevasse Canyon, Menefee,

Fruitland and Kirtland Formations. Most fossils found in place in the overburden have the highest potential scientific value because they are generally far more complete and less damaged than fossils that have weathered out into alluvial plains or stream channels. Some paleontological resources in the overburden would likely be damaged or destroyed in some way by the mining process (e.g., blasting, scraping, dragline). These impacts are the most serious type that would occur to paleontological resources, and they cannot be mitigated. Existing fossil collecting sites on five PRLAs that are presently under long-term scientific study would be destroyed. The construction of haul and access roads, new railroads, and surface facilities at mine sites would also destroy fossils.

Development of coal mines would also produce a population increase in the San Juan Basin. This and the building of additional roads in the EIS Region would permit increased human access to fossil-collecting sites in and near the mine development areas. As a consequence, unauthorized collection and vandalism of fossils would occur.

Despite the above impacts, however, paleontology may realize a certain degree of benefit from implementation of the No Action Alternative, because an excellent opportunity exists to interface paleontologic studies with contemplated mining activities. During mining, subsurface paleontologic information that would otherwise be unavailable to the scientific community would become available. Such data would be important for a thorough understanding of the life forms and environment of the region during prehistoric times. However, reclamation would limit the time that new exposures are available for continued fossil yields and maintenance of reference sections for future studies.

A comprehensive discussion of the potential extent of subsurface paleontological resources in the EIS Region is presented in Chapter IV (pages 1-3) of the Star Lake-Bisti Regional Coal Final ES (USDI, BLM, 1979c). The impacts of coal mining on paleontological resources under the PRLAs are treated in Chapter 3 (pages 24-25) of the Environmental Assessment for Coal Preference Right Leasing, New Mexico (USDI, BLM 1981a). Table 3-3 shows that under the No Action Alternative, an estimated total of 1,069 fossil localities would be disturbed.

Water Resources

Surface Water

Please refer to the end of this chapter.

Ground Water

Surface mining of coal beds would disrupt several aquifers in the San Juan Basin. As mining proceeds through alluvial channels, local sources of shallow ground water would be destroyed. Once these areas are reclaimed, less runoff and therefore less recharge may be available to ground water in the alluvium. However, this impact would be very localized.

Surface mining would destroy the stratified nature of the overburden as well as the coal seam itself. Although not important regional aquifers, the geologic units in the overburden do yield water locally to wells.

TABLE 3-3

ESTIMATED TOTAL OF FOSSIL LOCALITIES AND TOTAL ACRES DISTURBED BY ALTERNTIVE

Alternative	Total Acres Disturbed	Estimated Total Number Fossil Localities Disturbed
No Action	31,970	1,069
Bypass a/	6,130	271
Minimum Surface Owner Conflicts a/	19,302	136
Target a/	35,977	1,400
High a/	68,641	1,693

Note: a/ In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

Depending on the location of a particular mine, the coal-bearing zones are directly underlain by regional sandstone aquifers (Gallup or Dalton sandstones, for Crevasse Canyon Formation mines; Point Lookout Sandstone, for Menefee Formation mines; or the Pictured Cliffs Sandstone, for Fruitland Formation mines). These sandstones would not be completely destroyed by surface mining, but well yields could be affected through drawdown of water. If dewatering of underground mines were required, water yields from wells completed in these units would decrease.

Projected (model-derived) drawdowns for this alternative are shown on a plate in the map pocket at the back of this EIS. Maps for each major aquifer (Model Layers 1, 3, 5, 6, and 7--refer to Glossary) show drawdowns for the years 1987, 2000, 2020, and 2040. The greatest drawdowns (2,000 feet) would occur in the Westwater Canyon Member of the Morrison Formation (Layer 3) in the year 2020. The year 2040 map for this layer indicates a repressuring (or recovery of water level and inward movement of drawdown contours) in the middle of the cone of depression and continued depressuring (or drawdown of water level and outward movment of contours near the basin boundary.

Results would be similar for the Entrada Sandstone (Layer 1). The greatest drawndown (600 feet) would occur in the year 2020, with recovery of water level in the basin center and continued drawdown towards the basin boundary in the year 2040.

In the Gallup Sandstone (Layer 5), the greatest drawdown (1,000 feet) would occur in the year 2020 near the Gallup area coal tracts. Drawdown in Layer 6 (Crevasse Canyon Formation) would reach a maximum of 30 feet in the year 2020. Drawdown in Layer 7 (Upper Mesaverde Group Sandstones) would reach a maximum of 300 feet in the year 2000. Maximum drawdown and the years they would occur for this alternative are summarized in Table 3-4.

Effects of Surface Mining on Water Quality. The coal beds of the Crevasse Canyon, Menefee, and Fruitland Formations commonly have overburden of shales, carbonaceous shales, silstones, and sandstones; they are commonly underlain by shales.

During mining, the stratified nature of the overburden would be destroyed. Following mining, the mixed and crumbled overburden would be placed back into the pit and regraded. This mixed overburden would have a porosity greater than the original stratified material and would act as a single homogeneous aquifer overlying either the Gallup on Dalton sandstones (for Crevasse Canyon Formation mines), the Point Lookout Sandstone (for Menefee Formation mines), or the Pictured Cliffs Sandstone (for Fruitland Formation mines).

Van Voast, and others (1977) studied the effects of coal surface-mining on ground-water quality near Colstrip, Montana; these authors made the following generalized conclusions:

1. The chemical quality of water from coal beds differs greatly at different locations.

TABLE 3-4

MAXIMUM DRAWDOWNS IN MAJOR AQUIFERS OF THE SAN JUAN STRUCTURAL BASIN BY ALTERNATIVE

Alternative	Aquifer	Maximum Drawdown (Feet)	Year of Occurrence	General Area(s) of Occurrence
No Action	Entrada Sandstone	600	2020	Central Basin
	Westwater Canyon Member	2,000	2020	Central Basin
	Gallup Sandstone	1,000	2020	Gallup Area
	Crevasse Canyon Formation	30	2020	Gallup Area
	Upper Mesa Verde Group Sandstones	300	2000	Central Basin
Bypass	Entrada Sandstone	30	2026-2030	Southern and Central Basin
	Westwater Canyon Member	10	1996-2015	Central Basin
Minimum Surface Owner Conflicts	Entrada Sandstone	30	2031-2035	Southern and Central Basin
	Westwater Canyon Member	100	2021-2025	Central Basin
	Gallup Sandstone	300	1996-2005	Lee Ranch Area of Basin
Target	Entrada Sandstone	70	2026-2035	Southern and Central Basin
	Westwater Canyon Member	100	2021-2025	Central Basin (more extensive cone of depression for drawdowns in range of 10 to 70 feet).
	Gallup Sandstone	300	1996-2005	Lee Ranch area of basin (more extensive cone of depression for drawndowns in range of 10 to 70 feet).
High	Entrada Sandstone	70	2026-2035	Southern and Central Basin (slight further outward spread of 10 and 30 foot drawdown contours).
	Westwater Canyon Member	100	2021-2025	Central Basin
	Gallup Sandstone	300	1996-2005	Lee Ranch area of basin (slight further outward spread of cone of depression).

2. Strong differences in water-chemistry type and degree of mineralization occur in water at different depths at the same locality.

3. Temporal variations in ground-water quality seem to occur in or near spoil piles.

4. Water from alluvium is similar in quality to that from adjacent, unmined coal beds (in the San Juan Basin, however, water from alluvium is commonly of better quality than that from adjacent coal beds).

5. Dissolved-solids concentrations in water from alluvium are greater downgradient from the mining area than they are upgradient.

6. Spoils in younger mined areas contain water of similar quality to that from undisturbed aquifers.

7. Spoils from the oldest mined areas contain more highly mineralized water than that from nearby undisturbed aquifers.

8. In wells where a change in water quality is detected, the greatest changes are in concentrations of calcium, magnesium, and sulfate.

Although a similar study should be conducted in the San Juan Basin, these conclusions may be extrapolated to New Mexico in a generalized way. Water that resaturated the mixed and crumbled overburden would slowly mineralize and flow downgradient into shallow aquifers. If those aquifers contained water of better quality than that from the spoils, then a water-quality impact would occur. The magnitude of any impact is not predictable at this time for various reasons including unknown quality of water that resaturates the spoils, amount of recharge to spoils, and the type, distribution, and leachability of spoil materials (Woessner, 1979).

The greatest ground-water quality impact would probably be to the alluvial aquifer downstream from a mined area. The quality of water in the alluvium would be reduced by seepage from spoils and subsurface flow. Any bedrock aquifer (Gallup, Dalton, Point Lookout, Pictured Cliffs Sandstones) connected to a spoils area could also be impacted in a similar manner.

Wildlife

Species of High Federal Interest

Increased human activity associated with construction and coal mining may have an impact on migrating, wintering, or nesting prairie falcons, ferruginous hawks, and golden eagles. Specifically, the nests of one prairie falcon and four ferruginous hawks on the PRLAs, would be affected because of increased human activity (refer to Table 3-5). The indirect impacts of mining on birds of high federal interest would vary depending on the time of year. Birds would be vunerable to shooting at any time, usually while perching along roadsides. The nesting season would be the most critical season, with harrassment at nest sites an additional problem. Generally, for prairie falcons, ferruginous hawks and golden eagles, disturbance early in the nesting cycle (February-May) would result in some nest desertion, with a few birds

TABLE 3-5

RAPTOR NESTS AND ACREAGE DISTURBED BY ALTERNATIVE

Alternative	Acreage Disturbed [a] 1987	2000	Total	Total Number of Nests [b]
No Action	---	---	----	1 Prairie Falcon 4 Ferruginous Hawks
Bypass [c]	160	200	200	1 Ferruginous Hawks
Minimum Surface Owner Conflicts [c]	160	200	200	
Target [c]	160	200	200	1 Ferruginous Hawks 1 Golden Eagles
High [c]	212	200	300	1 Ferruginous Hawks 1 Golden Eagles

Note: [a] Deer and Elk Habitat.
[b] Nests of Species of High Federal Interest.
[c] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

attempting to re-nest. Human intrusion later in the nesting season when nestlings are being cared for would result in somewhat less nest desertion, although productivity of the raptor population as a whole would suffer.

Visual Resources

Four PRLAs (NM-3834, NM-3838, NM-6801 and NM-11916) overlap the designated Bisti and De-na-zin VRM Class II lands. All of these PRLAs are expected to be mined by underground methods. Disturbance caused by surface facilities for these mines could occur to the topography, scenic features, and visual quality on these PRLAs, which are composed primarily of fragile badlands.

Surface facilities on parts of NM-3838 and NM-11916 that lie outside of the Class II lands could reduce or disrupt the topographic and scenic view from the Bisti and De-na-zin WSAs. Parts of NM-3838 and NM-11916 are considered suitable for surface mining; this activity could have similar impacts on the nearby De-na-zin and Bisti Class II scenic areas.

All other PRLAs and projects fall within VRM Class III and Class IV lands. The same impacts as discussed above would occur, but would be less disruptive to the lower visual class of these areas.

Wilderness

Existing coal lease NM-0186615 and the southern portion of NM-0186612 are in close proximity to the Bisti WSA. The sights and sounds associated with surface mining of these leases could disrupt the wilderness characteristics of naturalness and opportunities for solitude in this WSA. Objectionable sounds could include sirens and noises from blasting, operation of equipment, and transportation. Visual effects could result from the view of mining structures and operations from within the WSA, lighting of the sky during night operation, and decreased visibility due to the dust produced by mining. The impacts of mining on the WSA if it was not designated as a wilderness area are discussed in the Bisti, De-na-zin, Ah-shi-sle-pah Proposed Wilderness Areas EIS (USDI, BLM 1982b).

Secondary or indirect impacts are expected to occur on all of the WSAs under the No Action Alternative. These impacts would result from increased use of the WSAs by an influx of people into the EIS Region. Increased littering, vandalism of scientific and educational values (paleontological and cultural), and off-road vehicle use are anticipated.

Other projects that could be expected to affect wilderness resources include the Star Lake-Bisti Railroad and the Fruitland Coal Load Transmission Line. Noise from the railroad would be audible in the Bisti and Ah-shi-sle-pah WSAs, and the transmission line would be visible from within the Ah-shi-sle-pah.

Recreation

Mining of the PRLAs could have impacts upon the quality of the recreational experience in some areas of the EIS Region. Surface mining of the Ah-shi-sle-pah WSA would destroy the scenic, backcountry, and primitive recreation values there. Surface mining of NM-11916 adjacent to the Bisti WSA would have detrimental effects on the primitive recreation experience in the WSA.

Surface mining on PRLAs NM-3918, NM-3919, NM-8745, and NM-9764 could cause visual and noise impacts to recreation facilities in the EIS Region, including the Chaco Culture National Historical Park, and especially the popular Pueblo Alto site.

Mining of several PRLAs and existing leases could potentially affect the Continental Divide National Scenic Trail (CDNST) if it is eventually routed near or through them. Surface mining could cause visual impacts to the route.

Noise from the Star Lake Railroad would affect the recreation experience in the Bisti WSA, the Chaco Culture National Historical Park, and possibly the CDNST.

An exact determination cannot be made of the amount of acreage removed from dispersed recreation use in any given year as a result of the various projects (those considered as contributing to the overall cumulative impacts of the No Action Alternative--refer to the "Analysis Framework" section of this chapter). Table 3-2 shows the total acreage that would be disturbed by mining on the PRLAs.

Increased population associated with coal mining in the EIS Region would result in increased participation in all types of recreation activities, thus causing more pressure on the area's recreation resources. Among the places receiving more use would be Navajo Lake, the San Juan River, the Chaco Culture National Historical Park, Angel Peak, and the De-na-zin and Bisti WSAs. Overcrowding could become a problem at some of these areas. Other impacts could include increased litter, vandalism, and damage resulting from ORV use.

Land Uses (Roads, Railroads, Pipelines, Transmission Lines)

The total acreage of rights-of-way for roads, powerlines, natural gas pipelines, and railroads located on the surface mineable portions of the PRLAs are listed in Table 3-6. Approximately 276 acres of these facilities rights-of-ways would be disturbed (refer to Table 3-6). On the underground mineable portions of the PRLAs, a total of 103 acres of rights-of-way would be affected (Table 3-7).

The natural gas pipelines could be jeopardized by subsidence fracturing the lines. Leakage in high pressure gas lines could create a safety hazard, and could disrupt service to customers. Subsidence could cause some change in wire tension and create undesirable sagging of power lines.

Other land uses such as livestock grazing and recreation are discussed in those sections of this chapter.

Transportation

Table 3-8 shows predicted increases in car and light duty truck traffic due to the development of the PRLAs and other projects in the EIS Region. Increases were projected for the years 1987 (start-up) and 2000 (peak production).

The largest increase in average daily traffic would occur along two major routes connecting the tri-city area of Farmington, Aztec, and Bloomfield.

TABLE 3-6

TOTAL LAND USE IMPACTS FROM DEVELOPMENT OF SURFACE MINEABLE FEDERAL COAL AT MINE STARTUP (1987) AND PEAK PRODUCTION (YEAR 2000) BY ALTERNATIVE (ACRES)

Alternative	Public Roads			Powerlines			Natural Gas			Proposed Railroad			Total
	1987	2000	Total	1987	2000	Total	1987	2000	Total	1987	2000	Total	
No Action	---	31	105	---	26	81	---	16	51	---	12	39	276
Bypass [a]	---	---	---	---	---	---	---	---	13	---	12	---	25
Minimum Surface Owner Conflicts [a]	---	---	---	---	33	96	---	---	---	---	---	5	101
Target [a]	---	3	30	---	68	177	---	24	57	---	---	5	269
High [a]	---	13	141	9	68	354	---	24	66	---	---	5	566

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

TABLE 3-7

TOTAL LAND USE IMPACTS FROM DEVELOPMENT OF UNDERGROUND MINEABLE FEDERAL COAL BY ALTERNATIVE (ACRES)

Alternative	Public Roads	Powerlines	Natural Gas Pipelines	Proposed Railroads	Total
No Action	71	11	21	---	103
Bypass [a]	---	---	---	---	---
Minimum Surface Owner Conflict [a]	33	11	23	27	94
Target [a]	33	11	23	27	94
High [a]	70	78	35	62	245

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

TABLE 3-8

PROJECTED ANNUAL AVERAGE DAILY TRAFFIC (ADT) INCREASES
ON HIGHWAYS IN THE EIS REGION BY ALTERNATIVE

Alternative	NM 32 [a]		I-40 [b]		NM 44 [c]		NM 53/344 [d]		NM 57 [e]		NM 170 [f]		NM 197 [g]		NM 371 [g]		NM 509 [g]	
	1987	2000	1987	2000	1987	2000	1987	2000	1987	2000	1987	2000	1987	2000	1987	2000	1987	2000
No Action	---	---	---	---	5,239	6,499	---	---	2,275	3,535	---	---	+6	+158	+84	+1,344	---	---
Bypass [h]	---	---	---	---	---	5,271	---	---	---	2,307	3,637	---	---	+26	+19	+52	---	---
Minimum Surface Owner Conflicts [h]	---	---	---	---	5,189	5,705	3,962	4,428	2,225	2,741	3,637	4,104	---	+26	+19	+52	+39	+505
Target [h]	---	---	---	---	5,189	5,808	3,962	4,428	2,225	2,844	3,637	4,104	+31	+175	+79	+294	+39	+505
High [h]	1,559	1,823	8.060	8,471	5,189	5,808	3,985	4,521	2,225	2,844	3,642	4,186	+31	+338	+167	+752	+62	+598

Notes:
[a] 1980 Baseline = 1,541 ADT
[b] 1980 Baseline = 8,055 ADT
[c] 1980 Baseline = 5,155 ADT
[d] 1980 Baseline = 3,923 ADT
[e] 1980 Baseline = 2,191 ADT
[f] 1980 Baseline = 3,579 ADT
[g] 1980 Baseline = No traffic surveys were completed for 1980
[h] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

One route includes segments of New Mexico 44 and New Mexico 57, and the other route is NM 371.

The highways listed in Table 3-8 are the major arteries to access the PRLAs, but other public roads (e.g., county and Bureau of Indian Affairs) are located in the vicinity. The No Action Alternative would add about 258 vehicles per day (vpd) to highways in the area by 1987 and about 4,190 vpd by the year 2000. This increase can be compared to the existing average vpd in Chapter 2 (refer to Table 2-11).

Increased noise, air pollution, traffic accidents, road congestion, maintenance and construction, and animal road kills could result from an increase in traffic. Because most of the rangelands are not fenced, additional traffic on these roads could result in an increase in the number of accidents involving livestock.

The increased number of accidents projected as a result of the additional traffic from mining under the No Action Alternative is listed in Table 3-9. Increases would occur on New Mexico 44 and New Mexico 371 in 1987 and the year 2000.

Social and Economic Factors

Employment

Development under the No Action Alternative would generate employment increases in two of the population centers analyzed for the EIS Region (refer to Table 3-10). The employment increase estimates for 1987 range from 18 percent in the Farmington area to 336 percent in Cuba. Estimates for the year 2000 range from the Farmington area's 16 percent to Cuba's 324 percent.

The EIS Region now experiences some unemployment, as do the specific communities associated with this alternative. Based on this fact and the employment needs of the region, it is estimated that 50 percent of the hiring related to the potential mining of the PRLAs and existing leases would be local hires (within the region). The exception to this would be direct employment in underground mining, because special skills are required; a 30 percent local hire figure was used. The balance of the people getting jobs as a result of leasing the PRLAs under this alternative would be in-migrants. These workers and their families would settle in the communities of the region that are closest to the tracts in production and that offer desirable services.

Infrastructure (Housing, Community Expenditures, Water Use, Wastewater Systems)

Housing needs would increase in the major communities throughout the region (refer to Table 3-11). An increase of 145 percent is predicted for 1987 in Cuba, and for the year 2000, the projected increase is 128 percent.

Public expenditures were examined by county and by community where figures were available. The source of funding for these expenditures was not analyzed, but a per-capita expenditure was used to determine the required increase in expenditures to maintain current levels. These figures are shown in Table 3-12. An increased tax base would be available for most counties.

TABLE 3-9
PROJECTED TRAFFIC ACCIDENT INCREASES ON HIGHWAYS BY ALTERNATIVE

Alternative	New Mexico 32 [a]		New Mexico 44 [b]		New Mexico 197 [c]		New Mexico 371 [d]	
	1987	2000	1987	2000	1987	2000	1987	2000
No Action	---	---	289	308	---	---	76	141
Bypass [e]	---	---	288	290	---	---	73	75
Minimum Surface Owner Conflicts [e]	---	---	289	296	---	---	73	75
Target [e]	---	---	289	298	18	22	77	90
High [e]	48	49	289	298	18	28	82	113

Notes: [a] 1980 Baseline = 47 Accidents
[b] 1980 Baseline = 288 Accidents
[c] 1980 Baseline = 17 Accidents
[d] 1980 Baseline = 72 Accidents
[e] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

TABLE 3-10

SOCIAL AND ECONOMIC FACTORS--
EMPLOYMENT INCREASES BY ALTERNATIVE

Alternative	Farmington		Cuba		Grants		Gallup		Milan		Crownpoint/Thoreau	
	1987[b]	2000[c]	1987[b]	2000[c]	1987[b]	2000[c]	1987[b]	2000[c]	1987[b]	2000[c]	1987[b]	2000[c]
No Action	4,973 18%	5,191 16%	1,144 336%	1,731 324%								
Bypass [a]	Same as No Action Alternative											
Minimum Surface Owner Conflicts [a]		3,070 10%			1,644 29%	2,680 33%			1,644 110%	2,680 102%		
Target [a]		5,136 16%	465 149%	773 145%	974 17%	3,172 40%			974 53%	3,172 121%		
High [a]		4,005 13%	468 150%	2,156 403%	1,338 24%	3,807 47%	804 12%	4,454 56%	1,338 72%	3,807 145%	1,806 474%	3,008 655%

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.
[b] Figures for each alternative represent only the increase due to coal leasing above the 1987 projected base.
[c] Figures for each alternative represent only the increase due to coal leasing above the 2000 projected base.

TABLE 3-11

SOCIAL AND ECONOMIC FACTORS--
EMPLOYMENT INCREASES BY ALTERNATIVE

Alternative	Farmington 1987[b]	Farmington 2000[c]	Cuba 1987[b]	Cuba 2000[c]	Grants 1987[b]	Grants 2000[c]	Gallup 1987[b]	Gallup 2000[c]	Milan 1987[b]	Milan 2000[c]	Crownpoint/Thoreau 1987[b]	Crownpoint/Thoreau 2000[c]
No Action			454 145%	687 128%								
Bypass [a]	Same as No Action Alternative											
Minimum Surface Owner Conflicts [a]												
Target [a]			183 58%	307 57%								
High [a]			189 60%	946 176%		1,528 10%		1,965 23%			716 107%	1,164 143%

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.
[b] Figures for each alternative represent only the increase due to coal leasing above the 1987 projected base.
[c] Figures for each alternative represent only the increase due to coal leasing above the 2000 projected base.

TABLE 3-12

SOCIAL AND ECONOMIC FACTORS--
INCREASE IN COMMUNITY EXPENDITURES ($000) BY ALTERNATIVE

Alternative	Farmington 1987[b]	Farmington 2000[c]	Cuba 1987[b]	Cuba 2000[c]	Grants 1987[b]	Grants 2000[c]	Gallup 1987[b]	Gallup 2000[c]	Milan 1987[b]	Milan 2000[c]	McKinley County 1987[b]	McKinley County 2000[c]
No Action	6,932 10%		850 175%	962 116%								
Bypass [a]	Same as No Action Alternative											
Minimum Surface Owner Conflicts [a]												
Target [a]		8,410 10%										
High [a]								4,440 21%				397 12%

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.
[b] Figures for each alternative represent only the increase due to coal leasing above the 1987 projected base.
[c] Figures for each alternative represent only the increase due to coal leasing above the 2000 projected base.

A required expenditure increase of 175 percent above the baseline was projected for Cuba for 1987. For the year 2000, the projected increase would be 116 percent. Although the mining operations that impact Cuba may not be located in Sandoval County, the Sandoval County tax base would be increased by the additional demand for residential and business properties by mining personnel living in Cuba.

Most expenditures change from year to year, and revenues can be adjusted by changing property value assessments, taxable values, and mill levies for property taxes, and rates for other types of taxes. Table 3-13 shows severance and property tax revenue increases. It appears that even with some gap between the time population increases occur and the time coal revenues start coming in, the San Juan and McKinley County communities and school districts should be able to meet their financial needs and perhaps have some surpluses. The Sandoval County area (involving the Cuba school district) would likely have increases with little revenue directly from mining.

Table 3-14 shows that water use is expected to increase as population increases, with allocations of water staying at the same levels. The estimated water use increases range from 12 percent in Farmington to 222 percent for Cuba in 1987. Year 2000 increases are estimated between 11 percent in Farmington and 147 percent in Cuba. Perhaps more important than the water use is the water right; Cuba presently is not shown to have a water right allocation. On an annual basis, the City of Aztec in the Farmington area has a current use higher than the recorded right.

Table 3-15 shows that the need for sewage treatment capacity would grow with the population, with a 177 percent increased needs in Cuba in 1987. The smaller communities would need to build new capacity. The increased capacity estimated to be needed by the year 2000 is 118 percent for Cuba.

Population increases would affect the availability of all public services provided by local and, to some extent, state government. Taxable valuation, mill levies, and allowable bonded indebtedness are all factors in determining the availability of funds for government services. The percent increase in the level of expenditure required to maintain the current level of infrastructural services has been discussed above.

Government, particularly local, has only a minor influence on the provision of housing and health care services in impacted areas. Because of this limitation and the reluctance or inability of the private sector to move quickly in meeting these needs, substantial use of substandard housing or the placement of mobile homes in unplanned trailer settlements outside incorporated and zoned areas may occur.

Demography

Table 3-16 shows the population change for the specific alternative and the percent change above the baseline. For 1987, a projected percent increase of 131 was made for Cuba.

Table 2-13 shows the ethnic distribtution of the 1980 population for the major communities in the EIS Region. Where population is estimated to grow (as it would in 1987 and the year 2000 in Cuba), change in the ethnic mix could bring social changes and changes in the political balance of power.

TABLE 3-13
ESTIMATED SEVERANCE AND PROPERTY TAX REVENUE INCREASES FROM COAL MINING OPERATIONS, 1987 AND YEAR 2000 BY ALTERNATIVE

Alternative	1987				Year 2000			
	Severance Tax Revenue		Property Tax Revenue		Severance Tax Revenue		Property Tax Revenue	
	($000)	% Increase over Baseline	($000)	% Increase over Baseline	($000)	% Increase over Baseline	($000)	% Increase over Baseline
No Action Baseline	28,683		2,621		19,292		1,762	
PRLAs					14,924	77	1,397	79
Bypass					2,861	15	263	15
Minimum Surface Owner Conflicts					9,718	50	1,384	79
Target	3,507	12	344	13	18,870	98	2,201	125
High Level	5,893	21	548	21	32,159	167	4,101	233

TABLE 3-14

SOCIAL AND ECONOMIC FACTORS--
WATER USE (ACRE FEET) INCREASE BY ALTERNATIVE

Alternative	Farmington 1987[b]	Farmington 2000[c]	Cuba 1987[b]	Cuba 2000[c]	Grants 1987[b]	Grants 2000[c]	Gallup 1987[b]	Gallup 2000[c]	Milan 1987[b]	Milan 2000[c]	Crownpoint/Thoreau 1987[b]	Crownpoint/Thoreau 2000[c]
No Action	2,010 12%	2,285 11%	1,002 222%	1,135 147%								
Bypass [a]	Same as No Action Alternative											
Minimum Surface Owner Conflicts [a]												
Target [a]		2,449 12%	305 68%	507 66%								
High [a]		307 68%	1,518 197%					828 24%			923 90%	1,537 120%

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.
[b] Figures for each alternative represent only the increase due to coal leasing above the 1987 projected base.
[c] Figures for each alternative represent only the increase due to coal leasing above the 2000 projected base.

TABLE 3-15

SOCIAL AND ECONOMIC FACTORS--
INCREASE IN NEED FOR WASTEWATER TREATMENT (IN 000'S GALLONS PER DAY) BY ALTERNATIVE

Alternative	Farmington 1987[b]	Farmington 2000[c]	Cuba 1987[b]	Cuba 2000[c]	Grants 1987[b]	Grants 2000[c]	Gallup 1987[b]	Gallup 2000[c]	Milan 1987[b]	Milan 2000[c]	Crownpoint/Thoreau 1987[b]	Crownpoint/Thoreau 2000[c]
No Action	1,279 10%		204 177%	231 118%								
Bypass [a]	Same as No Action Alternative											
Minimum Surface Owner Conflicts [a]												
Target [a]		1,558 10%	62 54%	103 53%								
High [a]			62 54%	309 158%			331 21%				121 80%	202 109%

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.
[b] Figures for each alternative represent only the increase due to coal leasing above the 1987 projected base.
[c] Figures for each alternative represent only the increase due to coal leasing above the 2000 projected base.

TABLE 3-16

SOCIAL AND ECONOMIC FACTORS--
POPULATION INCREASES BY ALTERNATIVE

Alternative	Farmington 1987[b]	Farmington 2000[c]	Cuba 1987[b]	Cuba 2000[c]	Grants 1987[b]	Grants 2000[c]	Gallup 1987[b]	Gallup 2000[c]	Milan 1987[b]	Milan 2000[c]	Crownpoint/Thoreau 1987[b]	Crownpoint/Thoreau 2000[c]
No Action			1,271 131%	1,923 116%								
Bypass [a]	Same as No Action Alternative											
Minimum Surface Owner Conflicts [a]					1,827 13%	2,977 15%			1,827 39%	2,977 31%		
Target [a]				859 52%	3,525 17%				1,082 23%	3,525 53%		
High [a]			520 54%	2,573 155%	1,486 10%	4,230 21%		5,481 21%	1,486 32%	4,230 64%	2,006 80%	3,342 110%

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.
[b] Figures for each alternative represent only the increase due to coal leasing above the 1987 projected base.
[c] Figures for each alternative represent only the increase due to coal leasing above the 2000 projected base.

TABLE 3-17
IMPACTS ON AMERICAN (NAVAJO) INDIANS BY ALTERNATIVE AND TYPE OF MINING

	Relocation/Disturbance									
	Residences			Known Gravesites			Known Sacred Sites			
Alternative	Surface	Underground	Total	Surface	Underground	Total	Surface	Underground	Total	Employment Increase
No Action	49	6	55	6	5	11	4	0	4	2,430
Bypass [a]	4	0	4	3	0	3	1	0	1	3,118
Minimum Surface Owner Conflict[a]	3	20	23	0	0		0	0	0	4,684
Target [a]	50	20	70	23-33	0	23-33	3	0	3	5,783
High [a]	345	110	455	25-35	0	25-35	3	1	4	7,544

Note: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

In the larger cities of the EIS Region such as Farmington, the rapid growth and change associated with the energy boom over the last several years have provided experience with social change. Therefore, further population changes would not have as high a level of impact on the social structure as they would in smaller, less experience towns. Some increased crime rates and service needs correlated with population increases (particularly with construction and other temporary types of labor) would be felt throughout the impacted areas.

The American Indians (primarily Navajos) nearest the PRLAs and existing leases would experience social changes. Mining would affect their lifestyle, especially the opportunity to use sacred areas, gathering areas for material used in religious ceremonies, and land on which they produce at least a part of their livelihood. These concerns are discussed more specifically in the next section of this chapter.

American Indian Concerns

Jobs in mine construction and operation could partially reduce the current high rate of Navajo unemployment. The availability of highly paid mining jobs could improve the standard of living within extended families. Navajos now holding wage jobs in other locations may be able to find employment near their local residence groups. Tribal and racial rivalries could increase as Navajos from other areas, members of other tribes, and non-Indians compete with local Navajos for employment.

Heavier traffic could increase the rate of accidental injuries and death to Navajos and their livestock.

Navajos living on PRLAs that are surface mined may be temporarily relocated. Individuals who feel themselves to be tied symbolically to particular geographic locations could experience emotional trauma from relocation.

Traditional roles within relocated residence groups could be disrupted. Individuals whose daily routine has been involved with such activities as securing water and tending to livestock could find themselves lacking their previous economic role within the residence group.

Access to portions of grazing use areas extending outside mine areas could be disrupted by mining operations. Rotational grazing practices could be interrupted for livestock operators losing use of a seasonal range. Some range outside mine areas could become unusable by livestock due to a decrease in the quantity and quality of available water.

As a general estimate, 10 years would elapse between the time an area was opened up by surface mining until grazing could be resumed. Reseeded areas could be grazed at the end of the second growing season, but the actual availability of the reclaimed area for grazing would depend upon mine plan operation.

The local market for silver jewelry and for rugs could expand with the population growth of non-Indians. However, weavers displaced from mine areas could be forced to find new gathering areas for minerals and plants used in

cleaning and dyeing wool. Weavers unable to maintain flocks of sheep and goats might have to purchase wool.

The process of identifying gravesite locations could be time-consuming and could result in delays for mining companies at the mine plan stage. Unidentified gravesites in surface mined areas would be destroyed. Navajos could become ill as a consequence of traditional beliefs in the evil released by disturbance of graves.

Access to sacred sites could be temporarily disrupted by mining operation. Sacred sites not identified before surface mining could be destroyed. The presence of non-Indians could reduce the privacy of sites.

Removal of natural vegetation during surface mining could force traditional religious practitioners to seek new plant and mineral gathering areas for ceremonial use. The seeds for many species may be very costly or may not be commercially available for inclusion in reseeding mixtures used by coal companies.

Figures are available that provide a measure of quantification of the impacts to Navajo for the No Action Alternative (refer to Table 3-17). These figures include the number of residences, presently identified gravesites, and sacred sites in the EIS Region. Employment figures are also listed as an indication of the number of potential jobs that could be filled by local Navajos and by other American Indians, as well as an indication of the number of non-Indians who could be moving into the region.

IMPACTS--BYPASS ALTERNATIVE

This alternative proposes to lease eight competitive tracts in September, 1983, all of which would be surfaced mined. These eight tracts are located next to existing and proposed mines and PRLAs (refer to Table 1-3), and it is assumed that the tracts would not be mined but would be bypassed unless adjacent mining operations extend into them.

Federal in-place reserves that would be leased total approximately 129 million tons, of which 113 million tons would be recoverable. Projected average annual coal production would be approximately 2.26 million tons from 1985 through the year 2007 for seven of the eight tracts.

Air Quality

The impacts would generally be of the same type as those identified under the No Action Alternative, but a larger area would be affected, and more mines are projected for the area. The total emissions under this alternative would be 6,196 tons of TSP per year. Table 3-1 shows that for this alternative, under worst-case meteorological conditions, the New Mexico State 24-hour standard of 150 ug/m3 would be exceeded by 13 ug/m3, with a TSP level at the mines of 163 ug/m3. This level is an increase of 63 ug/m3 over the No Action Alternative and could exceed the Class II 24-hour PSD limit in the vicinity of the mines. The areal extent of the impacts would generally be limited to short distances from the tract boundaries levels and federal ambient sandard would not be exceeded.

The visual range would be reduced to 65 miles.

The impact of this alternative on air quality is considered significant on a 24-hour basis in the local area of the mines. This impact would not occur at all time, but the occurance frequently has not been determined.

Topography and Mineral Resources

The type of impacts associated with leasing this alternative would generally be the same as those identified under the No Action Alternative. Table 3-2 shows that under this alternative, approximately 364 and 1,342 acres would be disturbed in 1987 and the year 2000, respectively. A total of 6,130 acres would be disturbed by mining, of which 600 acres would be for surface facilities. Total acreage disturbed under this and the No Action Alternative would be 38,100 acres. Impacts to construction materials (sand and gravel) would be of the same type as discussed in the No Action Alternative.

Paleontology

The type of impacts associated with leasing this alternative would generally be the same as those identified under the No Action Alternative. Table 3-3 shows that under this alternative, an estimated total of 271 fossil localities would be disturbed. The total number of fossil localities disturbed for this and the No Action Alternative would be 1,340.

Soils

Table 3-18 shows that mining facilities (structures, haul roads, storage areas, buildings, and parking areas) would cause the permanent loss of approximately 39 acres of the soil resource. A total of approximately 6,130 acres would be disturbed by eight surface mines. Annual surface disturbance from mining activities under this alternative would consist of approximately 417 acres per year. Surface disturbance at the onset of mining activities (1987) would include approximately 494 acres, and approximately 831 acres of surface disturbance would occur during peak production by the year 2000. Total acreage disturbed for this and the No Action Alternative would be of 38,100 acres (refer to Table 3-2).

Soil erosion would occur because of surface mining activities. Removal of vegetation cover would expose barren soil to wind and water action during stripping operations and stockpiling. Soil would be lost as levels of sedimentation and suspended dust particles increase.

Contamination of topsoil and subsoils may occur during surface mining operations. Accidental spills of toxic materials such as oils, chemicals, and waste materials may cause soil contamination. Contamination may also occur because of toxic and nutrient-deficient materials found within spoil piles, overburden and bedrock material.

Soil stability would be disrupted and changed. Stripping operations, handling, and stockpiling would cause a loss of soil fertility by the introduction of inferior subsoils and the biological death of soil micro-organisms. This would reduce soil productivity. Surface mining

TABLE 3-18

SOILS IMPACTS BY ALTERNATIVE

Alternative	Acres/Soil Disturbed		Acres Surface Reclaimed/Revegetated		Number Tracts Involved with Reclamation		Total Acres Permanently Lost	
	1987	2000	1987	2000	1987	2000	1987	2000
No Action [a/]								
Bypass	494	831	47.5	127	2	2	39.42	39.42
Minimum Surface Owner Conflicts	638	2,180	40	435	3	4	39.0	39.0
Target	1,762	4,417	48	914	2	12	78.42	78.42
High	3,697	3,559	40	1,522	1	14	78.42	78.42

Note: [a/] These figures are not available for the year 1987 and 2000.

activities would alter soil structure, causing changes in the soil-water regime. This action would affect water infiltration and permeability rates and the ability of the soil to hold water. Changes in the soil-water regime would limit plant growth.

Surface mining operations would cause compaction, resulting in lower permeability and infiltration rates. Handling, transporting, and stockpiling of soils would also cause compaction and mixing of various-textured soils and horizons. These activities may change bulk density and create different soils. Disturbances to soils would create significant impacts to paleontological and cultural resources, as discussed in those sections under this alternative.

Water Resources

Surface Water

Refer to the last section of this chapter.

Ground Water

The impacts associated with leasing this alternative will generally be the same type as those identified under the No Action Alternative. The Entrada Sandstone (Layer 1) and Westwater Canyon Member of the Morrison Formation (Layer 3) would be the only aquifers impacted by additional pumping and coal development under this alternative. A maximum additional drawdown (over and above that caused by the No Action Alternative) of 30 feet in the Entrada would occur between the years 2026 and 2030. A maximum additional drawdown of 10 feet in the Westwater Canyon Member would occur between the years 1996 and 2015. The plate in the map pocket of this EIS show the maximum differences between projected drawdowns of the No Action Alternative and the Bypass Alternative, and the time period during which those maximums would occur. The maximum additional drawdowns and the years in which they would occur are summarized in Table 3-4 .

Livestock Grazing

Table 3-19 shows that the Bypass Alternative would remove approximately 6,130 acres of native vegetation and 603 AUMs of livestock forage on BLM-administered allotments over the life of the mines. In addition, four reservoirs, 2 miles of fence and a well would be destroyed by surface mining. By the start of production in 1987, there would be 494 acres of native vegetation removed and 43 AUMs of forage lost. At the peak of mining in the year 2000, there would be 897 acres of vegetation removed and 82 AUMs of forage. The total disturbance for this and the No Action Alternative would be to 38,100 acres, 4,794 AUMs, 14 reservoirs, 23 miles of fence, 3 wells, 3 cattleguards, 2 corrals, and 2 windmills.

The loss of AUMs would be most severe for individuals whose livestock graze community allotments and have few AUMs. This loss would result in a disruption of the allottees' traditional lifestyles. Possibly, they would have to graze their flocks elsewhere. No reimbursement would be made for fence and corral destruction or for grazing suspensions caused by surface mining. It will not be known how severely the operators may be affected until mine plans are completed. On private surface, the surface owners would have to negotiate with the coal companies for reimbursement for the improvements.

TABLE 3-19

VEGETATION, AUMs, AND LIVESTOCK IMPROVEMENTS IMPACTED
BY ALTERNATIVE

Alternative	Vegetation Removed (Acres) 1987	2000	Total	Forage Removed (AUMs) 1987	2000	Total	Livestock Improvements (Total)
No Action - Total	9,894	18,356	31,970	2,208	2,969	4,191	10 Reservoirs
PRLAs	651	9,113	22,022	58	819	2,041	21 Miles of Fence
							3 Cattleguards
							2 Corrals
							2 Wells
							2 Windmills
Bypass [a/]	494	897	6,130	43	82	603	4 Reservoirs
							2 Miles of Fence
							1 Well
Minimum Surface Owner Conflict [a/]	638	2,180	19,302	114	455	4,268	9 Reservoirs
							13 Miles of Fence
							6 Wells
							1 Spring
Target [a/]	1,819	4,563	35,952	257	730	6,045	15 Reservoirs
							31 Miles of Fence
							9 Wells
							1 Spring
High [a/]	3,771	8,863	68,641	490	1,230	9,977	28 Reservoirs
							73 Miles of Fence
							1 Corral
							17 Wells
							1 Spring

Note: [a/] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

Wildlife

Mule Deer and Elk

During mining under this alternative, wintering mule deer and elk on the La Plata #1 tract would be impacted. Deer and elk utilize all 200 acres of this tract (refer to Table 3-5) and would be subject to stress from human activities associated with mining as well as the destruction of habitat. Mining on this tract would be completed by the year 2000.

Species of High Federal Interest

Increased human activity associated with mining under this alternative would have the same type of impacts on migrating, wintering and nesting prairie falcons, ferruginous hawks, and golden eagles that would occur under the No Action Alternative. Similar impacts would be expected in 1987 from mining on 160 acres of the Bisti #4 Tract. An additional 200 acres mined on the Bisti #4 Tract by the year 2000 would result in similar or possibly increased impacts depending on the proximity of mining to nest sites. Table 3-5 shows that the total number of nests of species of high federal interest that would be impacted by this and the No Action Alternative would be 1 prairie falcon, and 5 ferruginous hawks.

Cultural Resources

Table 3-20 shows that for this alternative, 13 sites have been recorded on the portions of the tracts containing federal coal or surface, and between 165 and 188 are predicted to occur. They would be destroyed by surface mining unless avoided and left intact. Utilizing the predicted site density for each tract, the number of sites that may be destroyed at mine start-up (1987) and peak production (2000) has been estimated. Between 19 and 20 sites may be destroyed in 1987, and between 26 and 78 in the area of surface disturbance in the year 2000. (These predictions assume that the sites are evenly distributed across each tract, which they are not. Therefore, the number of sites may be either higher or lower.) Total disturbance for this and the No Action Alternative would be to 184 recorded sites and between 707 and 730 predicted sites.

A portion of the Chacoan road system crosses the Hospah #1 Tract. Productive agricultural soils that have been associated with Anasazi farming communities are located on the Hospah #1, La Plata #1, and Star Lake West #2 tracts. Both the road system and the farming communities are significant in the prehistory of the San Juan Basin and may have National Register significance. They would be destroyed by mining.

Additional sites outside of the coal lease tracts may be disturbed or destroyed, limiting the scientific data available from them. The Advisory Council on Historic Preservation has listed actions that may cause adverse affects to cultural resources. They include: (1) destruction or alteration of all or part of a property, (2) isolation from or alteration of its surrounding environment, or (3) introduction of visual, audible or atmospheric elements that are out of character with the property or its setting (36 CFR 800.9).

TABLE 3-20

CULTURAL RESOURCE SITE IMPACTED BY ALTERNATIVE

Alternative	Sites Recorded 1987	2000	Total	Sites Predicted [b] 1987	2000	Total
No Action			171			542
Bypass [a]			13	19-20	26-78	165-188
Minimum Surface Owner Conflicts [a]			142	19	58-78	600-708
Target [a]			185	32-44	132-245	814-1,105
High [a]			231	32-44	132-245	1,727-2,295

Notes: [a] In order to determine cumulative impacts for a particular alternative include the impacts from new coal leasing plus the impacts of coal leasing from the No Action Alternative.

[b] These predictions assume that the sites are evenly distributed across each tract, which they are not. Therefore, the number of sites maybe either higher or lower.

TABLE 3-21

ACREAGE NOT AVAILABLE TO DISPERSED RECREATION USE BY ALTERNATIVE [a]

Alternative	Year 1987	2000
No Action		
Bypass	1,642	3,059
Minimum Surface Owner Conflicts	3,242	7,340
Target	10,052	15,357
High	23,962	30,145

Note: [a] These figures were derived by multiplying expected annual disturbance (acres) by the life of the mine (years) and adding surface facilities (acres) for each mine that would be in production during 1987 or the year 2000.

Increased unauthorized collection and vandalism to cultural resources would occur with increased population in the EIS Region.

Visual Resources

The type of impacts associated with this alternative would generally be the same as those identified under the No Action Alternative. Under the Bypass Alternative, all tracts are in either VRM Class III or IV, except for the La Plata #1 Tract, which is not classified. Surface mining and facilities on these tracts would alter the visual landscape to a degree unacceptable in their present classes.

Surface mining of two tracts, Bisti #4 and Bisti #6, would cause significant visual impacts. Bisti #4 is in an area known as the "Fossil Forest" which has good sightseeing values. Surface mining would destroy this quality. Bisti #6 is also in a scenic badlands area, and part of the tract is near the Bisti Wilderness Study Area/Area of Critical Environmental Concern. Mining would destroy the scenic quality of the tract as well as cause a visual impact to the scenic resources nearby for the life of the mine.

Visual B (enclosed in the map pocket) displays the VRM classes on those lands affected by mining operations as a result of additional federal coal leasing. No VRM Class II lands would be directly impacted as a result of additional leasing under the Bypass Alternative.

Wilderness

Under this alternative, surface mining of Bisti #6 would have the same type of impacts as described for existing leases under the No Action Alternative. Impacts would be greater on the parts of the tract closest to the Bisti Wilderness Study Area (WSA). Some disturbance can be expected in 1987, but mining of this tract should be completed before the year 2000.

Recreation

Under this alternative, mining-related population growth would increase dispersed recreation demand in the EIS Region. Mining operations would decrease the amount of public land available, resulting in additional pressures on the remaining lands. Impacts would include increased litter, vandalism, and ORV use, as discussed for the No Action Alternative.

Surface mining of the Bisti #6 Tract would destroy the scenic quality of that tract and impact the recreational experience in the nearby Bisti WSA.

Mining of certain tracts would have adverse impacts on some specific recreation resources due to noise and visual effects that would reduce the quality of the recreational experience, while some recreation resources could be destroyed. Acres not available for recreation are shown in Table 3-21.

Surface mining of the Bisti #4 Tract would destroy part of the scenic recreation area known as the Fossil Forest. The Star Lake West #2, Gallo Wash #1, and Hospah #1 tracts are within the corridor being studied for possible placement of the Continental Divide National Scenic Trail (CDNST). Surface mining of these tracts could disrupt actual trail location and aesthetics.

Land Uses (Roads, Railroads, Pipelines, Transmission Lines)

The type of impacts associated with this alternative would generally be the same as those identified under the No Action Alternative. Table 3-6 shows that under the Bypass Alternative, 13 acres of rights-of-way for natural gas pipelines would be disturbed by relocation or removal. Total disturbance under this and the No Action Alternative would be 105 acres of rights-of-way for public roads, 81 acres for powerlines, 64 acres for natural gas pipelines, and 39 acres for proposed railroads.

Transportation

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-8 shows predicted increases in car and light duty truck traffic. A traffic increase would occur on New Mexico 371 by 1987. By the year 2000, traffic increases would occur on New Mexico 44, New Mexico 197, and New Mexico 371.

Two competitive lease tracts under this alternative would require transportation other than the Star Lake Railroad. Due to the location of the La Plata #1 Tract north of Farmington, coal would have to be trucked to power plants (probably west of Farmington) as is currently being done with coal mined from the Black Diamond mine.

The projected increase in number of accidents due to this alternative is shown on Table 3-9. By 1987, an increase would occur on New Mexico 371. By the year 2000, accident increases would also occur on New Mexico 44.

Social and Economic Factors

Construction, production, and transportation workers on adjacent mines would be utilized for the mining operations on the tracts in the Bypass Alternative. Therefore, the type and extent of impacts associated with leasing this alternative would be the same as those identified under the No Action Alternative.

American Indian Concerns

The type of impacts associated with leasing this alternative would generally be the same as those identified under the No Action Alternative. Table 3-17 shows that 4 residences (surface mining), 9 known gravesites (surface mining), 5 known gravesites (underground mining), and 5 known sacred sites (surface mining) could be disturbed under this alternative. Total disturbance for this and the No Action Alternative would be 53 residences (surface mining), 6 residences (underground mining, 9 known gravesites (surface mining), 5 gravesites (underground mining), and 5 known sacred sites (surface mining).

IMPACTS--MINIMUM SURFACE OWNER CONFLICTS ALTERNATIVE

This alternative proposes to lease 11 tracts in September, 1983. Six of the tracts would be surface mined, and five would be underground mined. Federal in-place reserves that would be leased are approximately 916 million tons, of which 349 million tons are recoverable. Projected average annual coal

production would be approximately 7.15 million tons from 1985 through the year 2007 for 9 of the 11 tracts. It appears that minimal conflicts regarding mining would occur with the surface owners of these tracts.

Air Quality

The type of impacts associated with leasing this alternative would generally be the same as those identified under the No Action and Bypass Alternatives. Table 3-1 shows that for this alternative, under worst-case meteorological conditions, the New Mexico State 24-hour standard of 150 ug/m^3 would be violated by 84 ug/m^3 with a TSP level at the mines of 234 ug/m^3. The 234 ug/m^3 was obtained by modeling the mines from this and the No Action Alternative. This level could contribute to a violation of the PSD Class II 24-hour limit near the mines.

The total emissions from mining under this alternative would be 16,183 tons of TSP per year. The visual range near the mine boundaries would be reduced 13 miles to 60 miles. The areal extent of the impact is generally limited to short distances from the lease area boundaries.

Topography and Mineral Resources

Surface Mining

The type of impacts associated with leasing this alternative would generally be the same as those identified under the No Action Alternative. Table 3-2 shows that for this alternative, approximately 308 and 4,988 acres would be disturbed in 1987 and the year 2000, respectively. A total of 19,302 acres would be disturbed by mining, of which 1,050 acres would be for surface facilities. The total acreage disturbed for this and the No Action Alternative would be 51,272 acres.

Underground Mining

Subsidence impacts would remain the same as discussed under the No Action Alternative.

Surface facility construction would cause permanent changes of natural topography on about 400 acres.

Underground hazards and impacts to mineral development would remain the same as discussed in the No Action Alternative. Oil and gas potential exists in the area; drilling for these commodities could conflict with coal development.

Paleontology

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-3 shows that for this alternative, an estimated total of 136 fossil localities would be disturbed. The estimated total of fossil localities disturbed for this and the No Action Alternative would be 1,205.

Soils

Surface Mining

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Bypass Alternative. Table 3-18 shows that mining facilities (haul roads, structures, storage areas, buildings, and parking areas) would cause the permanent loss of approximately 39 acres of the soil resource. Approximately 19,302 acres of disturbance would be associated with six surface mines (510 acres per mine per year), and about 400 acres of surface disturbance with five underground mines. Surface disturbance at the onset of mining activities (1987) would consist of about 638 acres. Approximately 2,180 acres of surface disturbance would occur during peak mine production (year 2000). The total acreage disturbed by this and the No Action Alternative would be 51,272 acres (refer to Table 3-2).

Underground Mining

A maximum of 80 acres per underground mine would sustain surface disturbance in the form of access roads, parking areas, storage yards, buildings, utilities, and mine structures. Surface structures and facilities associated with underground mines would result in vegetation removal and soil disturbance and thus susceptibility to wind and water action. Sediment rates would increase slightly because of vegetation removal and unstable soils, and the placement of mine structures and facilities would cause some soil compaction. Soil characteristics and properties (bulk density, permeability, productivity, potential, structure, infiltration rates, and micro-organisms) would be affected to some extent because of soil handling, transporting, and stockpiling. Soil contamination may occur because of accidental spills (man-made products) and toxic material from disturbed soils, bedrock, and spoil piles.

Water Resources

Surface Water

Refer to the last section of this chapter.

Ground Water

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Additional coal development and pumping under this alternative would impact the Entrada Sandstone (Layer 1), Westwater Canyon Member of the Morrison Formation (Layer 3), and Gallup Sandstone (Layer 5). Maximum drawdown (over and above that caused by the No Action Alternative) in the Entrada would be 30 feet, occurring between the years 2031 and 2035. Additional maximum drawdown in the Westwater Canyon Member would be 100 feet, occurring between the years 2021 and 2025. Additional maximum drawdown in the Gallup Sandstone would be 300 feet, occurring between the years 1996 and 2005 in the vicinity of the Lee Ranch Tracts. The maximum additional drawdowns and the year in which they would occur are summarized in Table 3-4.

Livestock Grazing

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Bypass Alternative. Table 3-19 shows that the Minimum Surface Owner Conflicts Alternative would remove approximately 19,302 acres of native vegetation and 4,268 AUMs of livestock forage on BLM-administered allotments over the life of the mines. In addition, nine reservoirs, 13 miles of fence, six wells and a spring would be destroyed by surface mining.

By the start of production in 1987, 638 acres of native vegetation would be removed and 114 AUMs of forage lost. At the peak of mining in the year 2000, 2,180 acres of vegetation would be removed with 455 AUMs of forage. The total disturbance for this and the No Action Alternative would be to 51,272 acres, 8,459 AUMs, 19 reservoirs, 34 miles of fence, 8 wells, 3 cattleguards, 2 corrals, 2 windmills, and 1 spring.

Wildlife

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action and Bypass Alternatives. Table 3-5 shows that the total number of nests of species of high federal interest impacted by this and the No Action Alternative would be 1 prairie falcon, and 5 ferruginous hawks. Also impacted would be 200 acres of wintering mule deer and elk habitat.

Cultural Resources

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Bypass Alternative. Table 3-20 shows that for this alternative, 142 sites have been recorded on the portions of the tracts containing federal coal or surface, and between 600 and 708 sites are predicted. These would be destroyed by surface mining unless avoided and left intact. Utilizing the predicted site density for each tract, the number of sites that may be destroyed at mine start-up (1987) and peak production (2000) has been estimated at 19 and between 58 and 78, respectively. (These predictions assume that the sites are evenly distributed across each tract, which they are not. Therefore, the number of sites may be either higher or lower.) Sites on tracts to be underground mined may be destroyed or disturbed by subsidence, and additional sites inside and outside of the tracts may be directly or indirectly impacted. Total disturbance for this and the No Action Alternative would occur to 313 recorded sites and between 1,142 and 1,250 predicted sites.

Underground mining may destroy a portion of the Pierre's Ruin archaeological community that is not protected by P.L. 96-550. Mining may also introduce foreign audible and visual elements into the surrounding area, which may reduce the interpretive value of the site.

The Chacoan Great North Road crosses the Nageezi Tract and the Pierre's Ruin Community. Segments of the road, and associated features outside of the portion of the community not to be leased, may be destroyed. The Chacoan Southeast Road passes through the Lee Ranch West Tract. This portion of the road and any associated features or structures would be destroyed by mining.

The total disturbance would include segments of both the Chacoan Great North Road, Chacoan Southeast Road and that portion of the Chacoan road system that crosses the Hospah #1 Tract (approximately 9 miles).

Productive agricultural soils that have been associated with Anasazi farming communities are located on the La Plata #2 Tract. Previously recorded on this tract and on La Plata #4 is site LA 5605, an Anasazi community containing at least six roomblocks. This site may be destroyed by surface facilities associated with underground mining. Agricultural soils also occur on the three Lee Ranch tracts and the Divide Tract. If Anasazi farming communities are in these tracts, they would be destroyed by mining. The total disturbance would include agricultural soils that have been associated with Anasazi farming communities on the La Plata #2, Lee Ranch East, West, and Middle, Divide, Hospah #1, La Plata #1, and Star Lake West #2 tracts.

Visual Resources

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Under this alternative, all of the tracts are either in VRM Class III or IV, except for the La Plata #1 and #2 tracts which are not classified. Surface mining and surface facilities on these tracts would alter the visual landscape to a degree unacceptable in their present class.

Wilderness

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Under this alternative, surface facilities and operations for an underground mine on the Kimbeto #1 Tract could have some impacts on the wilderness character of the nearby Ah-shi-sle-pah Wilderness Study Area caused by noise, lighting, and sight of the facilities. Production on this tract is not expected until the year 2000.

Recreation

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Acres not available for recreation use during mining are shown in Table 3-21.

Under this alternative, the Lee Ranch East, West, and Middle, and Divide tracts are within the corridor being studied for possible placement of the Continental Divide National Scenic Trail. Surface mining of these tracts could disrupt actual trail location and cause a safety hazard for hikers.

Land Uses (Roads, Railroads, Pipelines, Transmission Lines)

Surface Mining

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-6 shows that under this alternative, 96 acres for powerlines and 5 acres for proposed railroads would be disturbed by relocation or removal. Total disturbance for this and the No Action Alternative would be 105 acres for public

roads, 177 acres for powerlines, 51 acres for natural gas pipelines, and 44 acres for proposed railroads.

Underground Mining

Table 3-7 shows that under this alternative, 33 acres of rights-of-way for public roads, 11 acres for powerlines, 23 acres for natural gas pipelines, and 27 acres for proposed railroads would be disturbed by subsidence, relocation or removal. Total disturbance for this and the No Action Alternative would be 104 acres for public roads, 22 acres for powerlines, 44 acres for natural gas pipelines, and 27 acres for proposed railroads.

Transportation

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-8 shows predicted increases in car and light duty truck traffic. Traffic increases on New Mexico 53/334 and New Mexico 509 would occur by 1987. By the year 2000, traffic increases would occur on New Mexico 44, New Mexico 57, New Mexico 53/334 and New Mexico 509. A major impact would occur on New Mexico 44, which is a heavily travelled artery from Bloomfield, New Mexico to Albuquerque. Upgrading of this segment has just begun.

The projected increase in numbers of accidents due to this alternative is shown on Table 3-9. By the year 2000, accident increases would occur on New Mexico 53/334 and New Mexico 44.

Social and Economic Factors

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Tables 3-10 through 3-13, 3-15, and 3-16 show the increases to Grants, Milan, and Farmington for employment, population, housing, community expenditures, water use and wastewater treatment.

American Indian Concerns

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-17 shows that 3 residences (surface mining), 20 residences (underground mining), 6 known gravesites (surface mining), 5 known gravesites (underground mining), and 4 known sacred sites (surface mining) could be disturbed under this alternative. Total disturbance for this and the No Action Alternative would be to 52 residences (surface mining) 26 residences (underground mining), 12 known gravesites (surface mining), 10 gravesites (underground mining), and 8 known sacred sites (surface mining).

IMPACTS--TARGET ALTERNATIVE

The competitive tracts in this alternative are those included in the Bypass and the Minimum Surface Owner Conflicts Alternatives, with additional tracts being added to achieve a production level that would fall within the Secretary of the Interiors's target range of 1.2 to 1.5 million tons of coal. The preferred alternative indicated here is that of the Regional Coal Team; it is not

necessarily that of the Secretary, nor does it bind the Secretary in any way in reaching a final federal leasing decision.

This alternative proposes to lease 24 tracts in September, 1983. Nineteen tracts would be surface mined and five would be underground mined. Federal in-place reserves to be leased are approximately 1.32 billion tons, with approximately .7 billion tons being recoverable. Projected average annual coal production would be approximately .13 billion tons from 1985 through the year 2007 from 21 of the 24 tracts.

Air Quality

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action and Bypass Alternatives, but over a larger area. The total emissions under the Target Alternative would be 18,803 tons of TSP per year. Table 3-1 shows that, under worst-case meteorological conditions, the New Mexico State 24-hour standard of 150 ug/m^3 would be violated by 84 ug/m^3 with a TSP level at the mines of 234 ug/m^3. The 234 ug/m^3 was obtained by modeling the mines from this and the No Action Alternative.

The PSD Class II 24-hour limit could be exceeded near the mine boundaries, but the TSP level would drop with distance from the mine. The maximum average annual mean was calculated to be 42 ug/m3, which does not exceed the state or federal annual standards.

Topography and Mineral Resources

Surface Mining

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-2 shows that for the Target Alternative, approximately 859 and 10,593 acres would be disturbed in 1987 and the year 2000, respectively. A total of 35,977 acres would be disturbed by mining, of which 2,100 acres would be for surface facilities. The total acreage disturbed by this and the No Action Alternative would be 67,947 acres.

Underground Mining

Subsidence impacts would remain the same as those discussed under the No Action Alternative.

Surface facility construction would cause permanent changes of natural topography on about 400 acres.

Underground hazards and impacts to mineral development would remain the same as those discussed under the No Action Alternative. Oil and gas potential exists in the region; drilling for these commodities could conflict with coal development.

Paleontology

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-3 shows that under the Target Alternative, an estimated 1,400 fossil localities would be disturbed. The estimated total number of fossil localities disturbed by this and the No Action Alternative would be 2,469.

Soils

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Bypass and Minimum Surface Owner Conflicts Alternatives. Table 3-18 shows that mining facilities (haul roads, structures, storage areas, buildings, and parking areas) would cause the permanent loss of approximately 78 acres of the soil resource. Approximately 35,977 acres would be disturbed by 24 surface mines, with annual disturbance being approximately 1,719 acres. Surface facilities would disturb approximately 400 acres associated with five underground mines. Surface disturbance at the onset of mining activities (1987) would consist of approximately 1,762 acres. Approximately 4,417 acres of surface disturbance would occur during peak mine production (year 2000). The total acreage disturbed by this and the No Action Alternative would be 67,947 acres (refer to Table 3-2).

Water Resources

Surface Water

Refer to the last section in this chapter.

Ground Water

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Additional coal development and groundwater pumping under the Target Alternative would create further drawdowns (over and above those caused by the No Action Alternative) in the Entrada Sandstone (Layer 1), Westwater Canyon Member of the Morrison Formation (Layer 3), and Gallup Sandstone (Layer 5). Maximum additional drawdown in the Entrada would be 70 feet, occurring between the years 2026 and 2035. Maximum additional drawdown in the Westwater Canyon Member would be 100 feet, occurring between the years 2021 and 2025, the same as that for the Minimum Surface Owner Conflicts Alternative. Maximum additional drawdown in the Gallup Sandstone would be 300 feet, occurring between the years 1996 and 2005, the same as that for the Minimum Surface Owner Conflicts Alternative. The plate showing drawdown however (in the map pocket of this EIS), indicates a more extensive cone of depression for drawdowns in the range of 10 to 70 feet. The maximum additional drawdowns and the years in which they would occur are summarized in Table 3-4.

Livestock Grazing

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Bypass Alternative. Table 3-19 shows that the Target Alternative would remove approximately 35,952

acres of native vegetation and 6,045 AUMs of livestock forage on BLM-administered allotments over the life of the mines. In addition, 15 reservoirs, 31 miles of fence, 9 wells and a spring would be destroyed by surface mining. A state sensitive plant species, Astragalus wingatus, could be removed by surface mining and facilities.

By the start of production in 1987, 1,819 acres of native vegetation would be removed and 257 AUMs of forage lost. At the peak of mining in the year 2000, 4,563 acres of vegetation would be removed with 730 AUMs of forage. Total disturbance for this and the No Action Alternative would be to 67,922 acres, 10,236 AUMs, 25 reservoirs, 52 miles of fence, 11 wells, 3 cattleguards, 2 corrals, 2 windmills, and a spring and Astragalus wingatus would be affected.

Wildlife

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action and Bypass Alternatives. Table 3-5 shows that the total number of nests of species of high federal interest impacted by this and the No Action Alternative would be a prairie falcon, 5 ferruginous hawk, and a golden eagle nest. Two hundred acres of wintering mule deer and elk habitat would also be destroyed.

Cultural Resources

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Bypass Alternative. Table 3-20 shows that for this alternative, 185 sites have been recorded on the portions of the tracts containing federal coal or surface and between 814 and 1,105 sites are predicted. The sites would be destroyed by surface mining unless avoided and left intact.

Using the predicted site density for each tract, the number of sites that may be destroyed at mine start-up (1987) and peak production (2000) has been estimated. Between 32 and 44 sites may be destroyed in 1987, and between 132 and 245 in the area of surface disturbance in the year 2000. (These predictions assume that the sites are evenly distributed across each tract, which they are not. Therefore, the number of sites may be either higher or lower.)

Sites on tracts to be underground mined may be destroyed or disturbed by subsidence. Additional sites inside and outside of the tracts may be directly or indirectly impacted. Total disturbance for this and the No Action Alternative would be to 356 recorded sites and between 1,356 and 1,647 predicted sites.

Chacoan roads disturbed would include segments of the Chacoan Great North Road, the Chacoan Southeast Road, and that portion of the Chacoan road system that crosses the Hospah #1 Tract (approximately 9 miles).

Productive agricultural soils are located on the Star Lake East #1 Tract. If Anasazi farming communities are on this tract, they would be destroyed by mining. The total disturbance would include agricultural soils that have been associated with Anasazi farming communities on the La Plata #2, Lee Ranch East, West, and Middle, Divide, Hospah #1, La Plata #1, Star Lake West #2, and Star Lake East #1 tracts.

Visual Resources

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. All of the tracts under this alternative are either in VRM Class III or IV, except for La Plata #1 and #2, which are not classified. Surface mining and surface facilities on these tracts would alter the visual landscape to a degree unacceptable in their present class. Surface mining of the Bisti #2 Tract would destroy scenic badlands and would affect the visual quality on the adjacent Bisti WSA/ACEC. The badlands on this tract are in a scenic quality A-rated area and provide good sightseeing values.

Wilderness

Under this alternative, surface mining of the Bisti #2 Tract would cause the same type of impacts to the Bisti WSA as those identified in the No Action Alternative for existing leases. Production on this tract would be expected to begin in 1987 and would have nearly doubled by the year 2000.

Recreation

Under this alternative, the type of impacts to dispersed recreation would be the same as those discussed under the No Action Alternative. Acres not available for recreation use are shown in Table 3-21.

Surface mining of the Bisti #2 Tract would destroy the scenic and recreational values of a portion of the Bisti Badlands and would have very detrimental visual and noise effects upon the quality of recreational experience in the Bisti WSA directly adjacent. Objectionable sounds would include sirens and noises from blasting, operation equipment, and transportation. Adverse visual effects would result from the sight of the mining operation from within the WSA, lighting of the sky during night operations, and decreased visibility due to dust produced by mining.

In addition to the tracts identified under the Bypass and Minimum Surface Owner Conflicts Alternatives as possibly impacting the Continental Divide National Scenic Trail, the Johnson Trading Post and Star Lake East #1 tracts also fall within the corridor.

Land Uses (Roads, Railroads, Pipelines, Transmission Lines)

Surface Mining

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-6 shows that under the Target Alternative, 30 acres of rights-of-way for public roads, 177 acres for powerlines, 57 acres for natural gas pipelines, and 5 acres for proposed railroads would be disturbed by relocation or removal. Total rights-of-way disturbance for this and the No Action Alternative would be to 135 acres for public roads, 258 acres for powerlines, 108 acres for natural gas pipelines, and 44 acres for proposed railroads.

Underground Mining

The underground impacts associated with mining under this alternative would be the same type and number as those identified for the Minimum Surface Owner Conflicts Alternative.

Transportation

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-8 shows predicted increases in car and light duty truck traffic. Traffic increases on New Mexico 44, New Mexico 57, and New Mexico 371 would occur by 1987. By the year 2000, traffic increases would occur on New Mexico 53/334, New Mexico 197 and New Mexico 170.

The projected increase in number of accidents due to this alternative is shown on Table 3-9. By the year 2000, accident increases would occur on New Mexico 44, New Mexico 197, and New Mexico 371. In 1987, the most significant increase would occur on New Mexico 371, which is presently being redesigned and paved. Once construction is completed, the accident rate for this highway may decrease.

Social and Economic Factors

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Tables 3-10 through 3-16 show the increases in Grants, Milan, Farmington, and Cuba for employment, housing, population, community expenditures, water use and wastewater treatment.

American Indian Concerns

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-17 shows that 50 residences (surface mining), 20 residences (underground mining), 23-33 known gravesites (surface mining), and 3 known sacred sites (surface mining) could be disturbed under this alternative. Total disturbance for this and the No Action Alternative would be to 99 residences (surface mining) 26 residences (underground mining), 29-39 known gravesites (surface mining), 5 gravesites (underground mining), and 7 known sacred sites (surface mining).

IMPACTS--HIGH ALTERNATIVE

This alternative proposes to lease all 39 tracts brought forward in the tract selection process in September of 1983. Of the total, 28 tracts would be surface mined and 11 would be underground mined. Federal in-place reserves that would be leased total approximately 1.94 billion tons, of which approximately 1.09 billion tons are recoverable. Projected average annual coal production would be approximately .24 billion tons from 1985 through the year 2007 for 36 of the 39 tracts.

Air Quality

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Minimum Surface Owner Conflicts Alternative, but over a greater areal extent. The total emissions under the High Alternative would be 30,514 tons of TSP per year. Table 3-1 shows that for this alternative, under worst-case meteorological conditions, the New Mexico State 24-hour standard of 150 ug/m3 would be violated by 86 ug/m3 with a TSP level at the mines of 236 ug/m3. With an annual average of 42 ug/m3. The 236 ug/m3 ws obtained by modeling the mines from this and the No Action Alternative.

The PSD Class II 24-hour increment could be violated near the mine boundaries, but would drop with distance from the mine. The visual range near the mine would be reduced 13 to 60 miles.

Topography and Mineral Resources

Surface Mining

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-2 shows that for this alternative, approximately 1,771 and 23,641 acres would be disturbed in 1987 and the year 2000, respectively. A total of 68,641 acres would be disturbed by mining, of which 3,500 acres would be for surface facilities. The total acreage disturbed by this and the No Action Alternative would be 100,611 acres.

Underground Mining

Subsidence impacts would remain the same as discussed in the No Action Alternative.

Surface facility construction would cause permanent changes of natural topography on about 880 acres.

Underground hazards and impacts to mineral development would remain the same as those discussed in the No Action Alternative. Oil and gas potential exists in the region, and drilling for these commodities could conflict with coal development.

Paleontology

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-3 shows that under this alternative, an estimated 1,693 fossil localities would be disturbed. The estimated total number of fossil localities disturbed by this and the No Action Alternative would be 2,762.

Soils

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Bypass and Minimum Surface Owner Conflicts Alternatives. Table 3-18 shows that mining facilities

(haul roads, structures, storage areas, buildings, and parking areas) would cause a permanent loss of approximately 78 acres of the soil resource. A total of approximately 68,641 acres would be affected by 28 surface mines, with annual surface disturbance consisting of approximately 2,230 acres per year. Surface facilities associated with 11 underground mines would disturb approximately 880 acres. Surface disturbance at the onset of mining activities (1987) would consist of approximately 3,697 acres, and approximately 8,559 acres of disturbance would occur during peak mine production (year 2000). Total acreage disturbed by this and the No Action Alternative would be 100,611 acres (refer to Table 3-2).

Water Resources

Surface Water

Refer to the last section of this chapter.

Ground Water

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Additional coal development and ground-water pumping under the High Alternative would create further drawdowns (over and above those caused by the No Action Alternative) in the Entrada Sandstone (Layer 1), Westwater Canyon Member of the Morrison Formation (Layer 3), and Gallup Sandstone (Layer 5). The drawdown difference for the Entrada, Westwater Canyon Member, and Gallup Sandstone are indistinguishable from the drawdown difference under the Target Alternative, except for slight outward movement of the drawdown contours (refer to the plates in the map pocket of this EIS). The maximum additional drawdowns and the years in which they would occur are summarized in Table 3-4.

Livestock Grazing

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Bypass Alternative. Table 3-19 shows that the High Alternative would remove approximately 68,641 acres of native vegetation and 9,977 AUMs of livestock forage on BLM-administered allotments over the life of the mines. In addition, 28 reservoirs, 73 miles of fence, 17 wells, a spring and a corral would be destroyed by surface mining. A state sensitive plant species, Astragalus wingatus, could be removed by surface mining and facilities.

By the start of production in 1987, 3,771 acres of native vegetation would be removed and 490 AUMs of forage lost. At the peak of mining in 2000, 8,863 acres of vegetation would be removed eliminating 1,230 AUMs of forage. Total disturbance for this and the No Action Alternative would be to 100,611 acres, 14,168 AUMs, 38 reservoirs, 94 miles of fence, 19 wells, 3 cattleguards, 3 corrals, 2 windmills, and a spring, Astragalus wingatus would be affected.

Wildlife

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action and Bypass Alternatives. Wintering mule deer and elk on the La Plata #3 Tract would be

subject to stress associated with mining on 100 acres of their range. In 1987, 66 acres of big game winter range would be mined, with disturbance occurring throughout the tract from associated activities. By the year 2000, mining would be complete.

Table 3-5 shows that the total number nests of species of high federal interest impacted by this and the No Action Alternative would be a prairie falcon, 5 ferruginous hawk, and a golden eagle nest. A total of 300 acres of wintering mule deer and elk habitat would also be destroyed.

Cultural Resources

The type of impacts associated with mining under this alternative would generally be the same as those identified under the Bypass Alternative. Table 3-20 shows that for this alternative, 231 sites have been recorded on the portions of the tracts containing federal coal or surface, and between 1,727 and 2,295 sites are predicted. They would be destroyed by surface mining unless avoided and left intact.

Using the predicted site density for each tract, the number of sites that may be destroyed at mine start-up (1987) and peak production (2000) has been estimated. Between 32 and 44 sites may be destroyed in 1987, and between 132 and 245 in the area of surface disturbance in the year 2000. (These predictions assume that the sites are evenly distributed across each tract, which they are not. Therefore, the number of sites may be either higher or lower.)

Sites on tracts to be underground mined may be destroyed or disturbed by subsidence. Additional sites inside and outside of the tracts may be directly or indirectly impacted. Total disturbance for this and the No Action Alternative would be to 402 recorded sites and between 2,269 and 2,837 predicted sites.

The Chacoan South Road crosses the Crownpoint Northeast and Crownpoint East tracts. It and any associated features or structures would be destroyed by mining. The total disturbance to Chacoan roads would include segments of the Chacoan Great North Road, the Chacoan South Road and that portion of the Chacoan road system that crosses the Hospah #1 Tract (approximately 11 miles).

Productive agricultural soils are located in the La Plata #3 and La Plata #4, Crownpoint Northeast, Star Lake East (LC) and Twin Buttes tracts. If Anasazi communities are in these tracts, they would be destroyed by mining. The total disturbance would include agricultural soils that have been associated with Anasazi farming communities on the La Plata #2, Lee Ranch East, West, and Middle, Divide, Hospah #1, La Plata #1, and Star Lake West #2, and Star Lake East #1, La Plata #3, La Plata #4, Crownpoint Northeast, Star Lake East (LC), and Twin Buttes tracts.

The mining of the Chico Wash South Tract under the High Alternative would have direct and indirect impacts to the Azabache Stage Station. Blasting may weaken or cause destruction of the standing walls.

Visual Resources

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. In this alternative, all of the tracts are either VRM Class III or IV, except for the La Plata Tracts #1, #2, #3, and #4, which are not classified. Surface mining and facilities on these tracts would alter the visual landscape to a degree unacceptable in their present class. Surface mining of the Chico Wash South Tract would greatly affect the scenic views from atop the mesas of the Ignacio Chavez area.

Wilderness

Surface mining of the Chico Wash South Tract would have the same type of impacts to the wilderness character of the Ignacio Chavez WSA as those discussed in the No Action Alternative for existing leases near the Bisti WSA. Impacts from production would be present in 1987.

Recreation

Under this alternative, the type of impacts to dispersed recreation would be the same as those discussed under the No Action Alternative. Acres not available for recreation are shown in Table 3-21.

Surface mining of the Chico Wash South Tract would have impacts to two specific recreation resources. The Azabache Stage Station is within this tract; its structures could be weakened by blasting. Access to the site would also be cut off. This entire tract is within a scenic viewshed experienced from atop the mesas of the Ignacio Chavez WSA directly to the south. Mining would severely alter this view.

Tracts within the Continental Divide National Scenic Trail corridor that have not been mentioned previously include the Star Lake East (LC), Crownpoint Northeast and Crownpoint (HC). Mining on these tracts would impact the corridor in the same same way as mining on other tracts discussed under the Bypass, Minimum Surface Owner Conflicts, and Target Alternatives.

Land Uses (Roads, Railroads, Pipelines, Transmission Lines)

Surface Mining

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-6 shows that under the High Alternative, 141 acres of rights-of-way for public roads, 354 acres for powerlines, 66 acres for natural gas pipelines, and 5 acres for proposed railroads would be disturbed by relocation or removal. Total right-of-way disturbance for this and the No Action Alternative would be 246 acres for public roads, 435 acres for powerlines, 117 acres for natural gas pipelines, and 44 acres for proposed railroads.

Underground Mining

Table 3-7 shows that for this alternative 70 acres of rights-of-way for public roads, 78 acres for powerlines, 35 acres for natural gas pipelines,

and 62 acres for proposed railroads would be disturbed by subsidence, relocation or removal. Total right-of-way disturbance for this and the No Action Alternative would be to 141 acres for public roads, 89 acres for powerlines, 56 acres for natural gas pipelines, and 62 acres for proposed railroads.

Transportation

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-8 shows predicted increases in car and light duty truck traffic. By the year 2000, traffic increases would occur on New Mexico 53/344, New Mexico 57 (from Crownpoint to Junction 371), and New Mexico 509.

The Ta-ha-bah Well, Hogback, Twin Buttes, Pinehaven, and Breadsprings tracts are located approximately 2 to 12 miles south of the Atchison-Topeka and Santa Fe mainline near Gallup. Coal developed on these tracts would be transported to market destinations via this railroad. The impacts of the construction of and traffic on haul roads from these tracts to loadout facilities on the mainline will be analyzed at the mine plan stage of the leasing process.

The projected increase in the number of accidents due to this alternative is shown on Table 3-9. An increase would occur on New Mexico 44, New Mexico 197, and New Mexico 371 by 1987. By the year 2000, accident increases would also occur on New Mexico 32, New Mexico 44, New Mexico 197 and New Mexico 371. New Mexico 371 is presently being redesigned and paved, and the accident rate for this highway may decrease once construction is completed.

Social and Economic Factors

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Tables 3-10 through 3-16 show the increases to Grants, Milan, Farmington, Cuba, Gallup, and Crownpoint-Thoreau for employment, housing, population, community expenditures, water use, and wastewater treatment.

American Indian Concerns

The type of impacts associated with mining under this alternative would generally be the same as those identified under the No Action Alternative. Table 3-17 shows that 345 residences (surface mining), 110 residences (underground mining), 25-35 known gravesites, and 3 known sacred sites (surface mining), and 1 known sacred site (underground mining) could be disturbed under this alternative. Total disturbance for this and the No Action Alternative would be to 394 residences (surface mining), 116 residences (underground mining), 31-41 known gravesites (surface mining) and 5 known gravesites (underground mining), 7 known sacred sites (surface mining), and 1 known sacred site (underground mining).

MITIGATING MEASURES

The mitigating measures listed below would be applied to impacts identified under the alternatives. These measures would be in addition to requirements of State and Federal laws, regulations, and standard operating procedures (refer to Appendices A-4 and 5).

Air Quality

Potential violations would be reduced by changing the configuration of the pit area and mining facilities so they are not next to the boundary and downwind of the worst-case meteorological conditions. Emissions (TSP) would be reduced by decreasing the amount of coal mined and the acres disturbed per year.

Paleontology

Mitigating measures for impacts on paleontological resources usually involve data recovery, including the scientifically controlled excavation, analysis, and curation of a sample of the affected resource base.

Some elements of an adequate mitigation program would include:

1. An intensive inventory to identify any surface-exposed fossils.
2. Coordination and consultation with the scientific community to evaluate fossil significance.
3. A predictive model for fossil localities affected by the proposed project.
4. An adequate construction monitoring program.
5. Implementation of a data-recovery program.

Development of community education projects to enlist local support for protecting the fossils in place, complemented by more vigorous enforcement of restrictions on off-road vehicle use in areas of rich fossil deposits, Private or institutional support for an ongoing paleontological research program in the general EIS Region might also offset losses otherwise incurred.

The effectiveness of mitigation is difficult to assess. It is limited by such factors as geologic formation, time constraints, type of paleontological resources, and management expertise. The basic requisite for mitigation is to satisfy scientific criteria for the retrieval of paleontological data and material that will compensate in some way for the irretrievable loss of potentially significant fossils during the mining operation.

Water Resources

It is recommended that ground water used for reclamation meet the following water quality criteria: specific conductance $\leq$4000 micromhos and sodium adsorption ratio $\leq$18. Waters not meeting these criteria would require treatment to the above levels before being used for reclamation.

Livestock Grazing

Mitigating measures for this resource include salvage of the well casing down to the depth that strip mining would occur, and reestablishment of the well once reclamation is accomplished. Fences and corrals would be

relocated outside the mine area to keep livestock out during mining. The fences would be replaced in their original locations once reclamation is complete. Surface facilities for underground mines would be located as much as possible so as not to impact fences, reservoirs, or wells. Assistance would be given to residents to assist them in relocating their flocks if their grazing privileges are suspended. Mitigation of impacts on state plants of special concern would be required by the New Mexico Natural Resource Department.

Wildlife

Public access would be prohibited yearlong to the La Plata #1 and #2 tracts to protect wintering mule deer and elk habitat. This would include prohibiting hunting or recreational use on lease areas by mining employees to lessen deer and elk disturbance.

Cultural Resources

No surface-disturbing activities would be conducted within the expanded community boundary of Pierre's Ruin Community. Also recommended in the community expansion are: no surface subsidence would occur; the monitoring and surveillance program established by BLM archaeologists would include additional community sites and more frequent inspections; and a fence would be constructed around the community perimeter to restrict access. (The 160 acres of the southwest corner of the community is an Indian Allotment. Permission would be needed before it can be included in the fencing; if permission is not gained only federal surface would be fenced.) All gates would be locked.

Before lease issuance, studies will be conducted by the lessee under consultation with the National Park Service to study the effect of blasting on structures within the Chaco Culture National Historical Park.

Visual Resources

All areas of surface disturbance (particularly severe disturbance) would be reclaimed to a scenic quality eligible for their pre-mining VRM Class or better. Compliance with OSM regulations would usually ensure the required scenic quality.

Wilderness

Mitigating measures for the Bisti #6 Tract would include a berm to minimize visual intrusion in the Bisti WSA and shading of night lighting for the same purpose. Reclamation would also be done in a manner so as to keep the sight of the incongruous terrain at a minimum from inside the WSA. Transportation routes would avoid the Bisti WSA to the greatest degree possible. If the Ah-shi-sle-pah WSA is designated as wilderness, surface facilities would be located in a manner so as to cause the least visual and audible impacts upon it.

Recreation

If it appears that the CDNST would be routed through or next to the Star Lake West #2, Gallo Wash #1, Hospah #1, Star Lake #1, and Johnson Trading Post tracts, provisions would be made to protect or temporarily relocate actual trail location and the safety of hikers.

Mitigating measures for the Bisti #2 Tract would be the same as those identified for the Bisti #6 Tract under the wilderness discussion above.

Access would be provided to the Azabache Stage Station after mining is completed.

Land Uses

Surface Mining

Mitigating measures for public roads, powerlines, the proposed Star Lake Railroad, natural gas pipelines, telephone lines, and other rights-of-way would include relocation of right-of-way segments or the entire right-of-way around a tract without inhibiting the continued operation of the facility. An agreement would have to be reached with the right-of-way holder; expenses would be incurred by the coal lessee.

Underground Mining

Surface facilities related to underground mines would be located to avoid roads, powerlines, and natural gas pipelines. This would be accomplished during the mine plan stage when specific facility location can be determined. If the surface mine facilities cannot be located to avoid the existing rights-of-way or roads, relocation of the facilities may be necesary. An agreement would have to be reached with the right-of-way holder or the entity maintaining the road; expenses would be incurred by the leaseholder.

Mitigating the impact of subsidence on powerlines and roads would require mining methods that would eliminate any possibility of major subsidence.

Two types of mitigation exist for subsidence of natural gas pipelines. One would be to require mining methods that would eliminate all subsidence. Another would be to relocate that segment of the natural gas pipeline crossing the underground mine area. An agreement would have to be reached with the right-of-way holder; expenses would be incurred by the leaseholder. Relocation would be the preferred mitigating measure because any mining method could be subject to some degree of subsidence, even some time after abandonment.

Mitigation of the additional impacts of subsidence on the proposed Star Lake Railroad would require the use of mining methods that would eliminate any possibility of subsidence unless the mine development could be designed to avoid or otherwise protect the railroad. This would require an agreement between the coal company and the Atchison, Topeka, and Santa Fe Railroad Company. Another mitigating measure would be to resurvey and design the construction plans to avoid the entire Hospah #2 Tract. Rerouting the proposed railroad may not be feasible, depending on the terrain of possible alternative routes.

Impacts of subsidence on telephone lines in underground mineable areas would be mitigated by requiring mining methods that would eliminate the possibility of major subsidence.

Transportation

Leaseholders would share costs with the State of New Mexico for major roadway improvement such as construction of shoulders. This measure would be applied to those roadway segments that are extremely hazardous and heavily travelled by coal company employees and equipment. Costs would be paid in proportion to tonnages hauled by truck, and to the average daily truck traffic from the lease to the closest loadout facilities of the Atchison-Topeka and Santa Fe mainline or the proposed Star Lake Railroad. To eliminate overweight damage to existing highways, the use of conveyor systems to transport coal to the nearest railroad loadout facility may also be required.

American Indian Concerns

Arrangements would be provided by signed agreements between the owner of an occupied dwelling and the lessee for the relocation of the occupied dwellings. Other arrangements would be made at the mine plan stage after a search has been conducted to identify all possible gravesites, occupied dwellings, and churches. This may apply to both fulltime and seasonally occupied dwellings.

The lessee would also arrange to relocate churches and gravesites in accordance with state law. The lessee will have to show that mining will not impact churches before it is to be allowed.

The following provisions of BLM policy would be followed as closely as possible:

1. Residences and resource use areas would be relocated within the same chapter boundaries. Relocation will be determined during mine plan review.

2. Relocation (or reimbursement) details would be worked out with occupant/user and mining company participation.

3. Relocations would be staggered so that they do not all occur at the same time in the same vicinity.

4. Families would be relocated as a unit and not split up.

5. The new location would have sufficient water and forage to accomodate the occupants'/users' displaced flocks or herds.

UNAVOIDABLE ADVERSE IMPACTS

The same type of unavoidable adverse impacts identified in the No Action and Bypass Alternatives would occur in the last three alternatives only the impacts would be greater and would be commensurate with the level of mining. Because of this, the reader is referred to the narrative in the first two alternatives for the type of impacts that would occur in the last three alternatives. The discussion of unavoidable adverse impacts is limited to impacts that can not be mitigated during mining and would remain during the life of the mine and/or after mining and reclamation operations are completed.

No Action Alternative

Some short periods of local violations of air quality standards would result from mining associated activities if unfavorable meteorological conditions persist for several hours.

Destruction of overlying strata on approximately 31,970 acres on surface mines and subsidence on 67,081 acres overlying underground mines would occur. Underground mining would result in the loss of 50 percent of the mineable coal resources.

Nearly 1,069 estimated fossil localities of the late Cretaceous Crevase Canyon, Menefee, and Kirtland/Fruitland formations could be destroyed or damaged during mining activities. Fossils of these formations are generally vertebrate fossils of dinosaurs and early mammals. The Kirtland/Fruitland formation contains an unparalled record of one of the most important episodes in history-the abrupt change from domination by dinosaurs to domination by mammals. Information and data from sites destroyed by mining or sites disturbed or destroyed through unauthorized excavation would be lost indefinitely to science and education.

Harassment and shooting of non-game fauna would occur due to increases in human population and activity in the areas of the mines. Some disturbance to four ferruginous hawks, and one prairie falcon and their nesting sites could occur and possible cause and abandonment of some of the nests. In most cases it is likely the nesting pairs would relocate to another area. Nesting populations of these raptors in the State of New Mexico are rare to uncommon (Hubbard, 1978).

Population increase in the region and subsequent increase in demand for recreation could result in over utilization and crowding of existing recreation development; Chaco Cultural National Historical Park, Navajo Lake, San Juan River, Angel Peak, and the De-na-zin and Bisti WSA. Noise associated with mining activities and the destruction of scenic natural land forms would distract from the quality of the recretional experience in the nationally known and visited Bisti and De-na-zin WSAs.

Significant increases in traffic in the San Juan Basin would cause traffic congestion, increased accidents (365 in 1987 and 449 in 2000) and road kills (including livestock) and a demand for more frequent road maintenance.

Population would increase by 1,923 in the Cuba area in the year 2,000, housing needs would increase by 687 units in Cuba as a result of new compeitive coal leasing. The additional income and buying power generated would increase the local rate of inflation. The effects of this inflation would be felt most acutely by persons living on fixed incomes and those with lower-paying employment such as trade and service workers. The greatly increased labor requirements of the mining and construction industries together with their relatively high wage scales, would make it more difficult for employers in lower-paying industries and government to hire and retain qualified employees.

Capital and operating expenditure requirements of local counties, school districts, and municipalities would rise as a result of the need to expand public services and facilities. Unless communities plan needed

improvements in advance and assure adequate funding, there would be at least a temporary deterioration in the quality of services, causing inconvenience and dissatisfaction among those affected.

Fifty-five Navajo families could experience significant impacts on their traditional lifestyle through the influx of non-Indians into the area. Mining could disrupt the use of four sacred areas and gathering areas for materials used in religious ceremonies. Eleven graves could be destroyed. Traditional lifestyles of grazing livestock could be distrupted for the life of the mine if relocation was not satisfactorily completed.

Bypass Alternative

Unavoidable adverse impacts associated with mining this alternative would generally be the same type as those identified under the No Action Alternative with the following exceptions (figures include the No Action Alternative).

A portion of 1,340 fossil localities of the late Cretaceous Crevase Canyon, Menefee and Kirtland/Fruitland formations could be destroyed or damaged during mining activities.

Soil productivity would be lost and regained periodically (regular intervals) on approximately 38,100 acres during the life of the mines. An unquantified amount of soil would be lost from disturbed areas prior to reclamation or revegetation. Local intense thunderstorms (summer and spring snow melt would result in high runoff events causing further degradation of surface soils through water erosion. Soil disturbance during the life of the mines would result in wind erosion. Removal and handling operations would cause a loss of topsoil and destruction of soil structure. Incorporation of clay and silt material from the subsoils would cause degradation to shallow loamy topsoils. The productive capacity of the soils involved would be decreased from the complete destruction of the natural soil profiles and fromk the impacts to the soils properties which determine moisture regime and fertility.

Loss of 38,100 acres of native vegetation and 4,794 AUM's of forage for livestock for the length of the mine would be unavoidable due to mining.

Harassment and shooting of animals due to increased human activity in the area and loss of wildlife habitat. One prairie falcon, 5 ferruginous hawks, and nesting sites kcould be disturbed or disrupted due to mining activities.

A portion of 709-730 predicted sites of the prehistoric and historic human record of the San Juan Basin would be unavoidably destroyed. All of the cultural resources may not be located during inventory, and those not located would be destroyed by surface mining. Of those cultural resources located and recorded, not all would be included in additional data recovery procedures developed in the mitigation plan. The data from these cultural resources would be lost. The portion of any site not included in further data recovery would be destroyed by surface disturbance, and the data contained in it would be lost.

If subsidence occurs in areas containing cultural resources, it could destroy a portion of the resource.

Sites disturbed or destroyed through unauthorized excavation, collection or other disturbances would loose a portion of their data. Monitoring, surveillance, fencing, and other protective means cannot prevent all unauthorized activities. All sites destroyed would loose their potential for visitor interpretation.

Aesthetics of the Bisti Management Area would be impacted by noise due to mining of Bisti #6. The recreational experience of hikers on the CDNST could be impacted due to the noise level and destruction of natural landforms if the trails is actually routed through any of these tracts. Surface mining of Bisti #4 would destroy part of the scenic recreation area known as the fossil forest.

In 1987 762 accidents and in the year 2000 814 accidents would be unavoidable in the region.

Fifty-nine Navajo families would be relocated, fourteen gravesites and five sacred sites could be disturbed under this alternative and can not be avoided.

Minimum Surface Owner Conflicts Alternative

Unavoidable adverse impacts associated with mining this alternative would generally be the same type as those identiifed under the No Action and Bypass Alternative, with the following exceptions (figures include the No Action Alternative).

Destruction of overlying strata and loss of soil productivity and regained periodically on an approximately 51,272 acres and subsidence on up to 88,081 acres.

A portion of an estimated 1,205 fossil locality of the late Cretaceous Crevase Canyon, Menefee and Kirtland/Fruitland formation could b destroyed or damaged during mining activities.

Loss of 51,272 acres of native vegetation and 8,459 AUM's of forge for livestock grazing for the length of the mine would be unavoidable.

One prairie falcon, 5 ferruginous hawks, and their nesting site could be disturbed or disrupted due to mining activities for the life of the mine.

A portion of 1,142-1,250 predicted sites of the prehistoric and historic human record of the San Juan Basin would be unavoidably destroyed.

In 1987 727 accidents and in 2000 820 accidents would be unavoidable in the region.

Population would increase by 2,977 (15%) in the Grants area and 2,977 (31%) in the year 2000, increase in housing needs would not be significant as a result of new competitive coal leasing.

Seventy-eight Navajo families could be relocated, and a portion of gravesites and 8 known sacred areas could be destroyed due to mining activities.

Target Alternative

Unavoidable adverse impacts associated with mining this alternative would generally be the same type as those identiifed under the No Action and Bypass Alternative, with the following exceptions (figures include the No Action Alternative).

Destruction of overlying strata and loss of soil productivity and regained periodically on an approximately 67,947 acres and subsidence on up to 88,081 acres.

A portion of an estimated 2,469 fossil locality of the late Cretaceous Crevase Canyon, Menefee and Kirtland/Fruitland formation could b destroyed or damaged during mining activities.

Loss of 67,922 acres of native vegetation and 10,236 AUM's of forage for livestock grazing for the life of the mine would be unavoidable.

One prairie falcon, 5 ferruginous hawks, and one golden eagle and their nesting site could be disturbed or disrupted due to mining activities for the life of the mine.

A portion of 1,356-1,647 predicted sites of the prehistoric and historic human record of the San Juan Basin would be unavoidably destroyed.

In 1987 749 accidents and in 2000 859 accidents would be unavoidable in the region.

Population would increase by 2,782 (168%) in the Cuba, 3,525 (17%) in Grants and 3,525 (53%) in Milan in the year 2000, increase in housing needs would increase by 944 (185%) units in Cuba in 2000. Increase in housing unit needs for Grants and Milan due to new federal coal leasing are not significant.

One-Hundered and twenty five Navajo families could be relocated, and a portion of 44 gravesites and seven sacred areas could be destroyed due to mining activities.

High Alternative

Unavoidable adverse impacts associated with mining this alternative would generally be the same type as those identiifed under the No Action and Bypass Alternative, with the following exceptions (figures include the No Action Alternative).

Destruction of overlying strata and loss of soil productivity and regained periodically on an approximately 100,611 acres and subsidence on up to 104,162 acres.

A portion of an estimated 2,762 fossil locality of the late Cretaceous Crevase Canyon, Menefee and Kirtland/Fruitland formation could b destroyed or damaged during mining activities.

Loss of 100,611 acres of native vegetation and 14,168 AUM's of forge for livestock grazing for the length of the mine would be unavoidable.

One prairie falcon, 5 ferruginous hawks, and one golden eagle and their nesting site could be disturbed or disrupted due to mining activities for the life of the mine.

A portion of 2,269-2,837 predicted sites of the prehistoric and historic human record of the San Juan Basin would be unavoidably destroyed.

Noise and visual impacts upon the wilderness character of Ignacio Chavez WSA as a result of surface mining of Chico Wash South would be unavoidable.

In 1987 802 accidents and in 2000 937 accidents would be unavoidable in the region.

Population would increase by 4,496 (271%) in the Cuba, 4,230 (21%) in Grants and 5,481 (21%) in Gallup, 4,230 (64%) in Milan, and 3,342 (10%) in Crownpoint/Thoreau. Housing needs would increase by 1,633 (304%) units in Cuba, 1,528 (10%) units in Grants, 1,965 (23%) units in Gallup, and 1,164 (143%) units in Crownpoint/Thoreau due to new federal coal leasing.

Five-Hundered and ten Navajo families could be relocated, and a portion of 46 gravesites and eight sacred areas could be destroyed due to mining activities for an indefinite period of time.

RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

The same type of relationship between short-term use and long-term productivity in the No Action Alternative would occur in the four alternatives. However, the the difference in magnitude would be commensurate with the level of mining. The reader is referred to the narrative in the No Action Alternative for the type of impacts that would occur in the remaining four alternatives.

No Action Alternative

At each mine, "deep" wells would be drilled and developed for short-term use for mining operations. After mining ceased, these wells could be transferred to the surface owner and used for livestock and possibly domestic purposes if the water quality were good enough. This short-term use for mining operations would represent an enhancement of the long-term productivity of the water resource by providing a more reliable water supply for the area.

Surface and underground mining (short-term) would cause soil disturbance, soil loss, and loss of soil productivity on approximately 31,970 acres. The acreage remaining after reclamation or revegetation would be returned to livestock grazing, wildlife uses and non-coal mineral activities. Reclamation or revegetation success (short-term) would determine long-term productivity and uses.

Coal development would cause long-term changes in lifestyles, cultural and religious values for 55 Navajo families living on or near the PRLAs.

There would be positive long-term impacts on productivity through: (1) an increase in the size of the labor force; (2) infrastructure improvements useful for commercial and industiral development; and (3) increased income and

buying power which would contribute to the development of a larger and more diversified trade and services sector. There would also be one potential negative impact on productivity, i.e., an increased vulnerability to economic distruptions caused by fluctuations in the coal industry.

There would be a shift in the long-term from a remote rural area to more populated industralized one. The short-term increase in population would result in expansion of community infrastructure in the longterm.

Bypass Alternative

Surface mining would disturb 38,152 acres. Fifty-nine families would have changes in their lifestyles.

Minimum Surface Owner Conflicts Alternative

Surface mining would disturb 51,272 acres. Seventy-eight families would have changes in their lifestyles however these residents have consented to mining.

Target Alternative

Surface mining would disturb 57,974 acres. The lifestyles of 125 families would be changed.

High Level Alternative

Surface mining would disturb 100,611 acres. The lifestyle of 510 families would be changed.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The same type of irreversible and irretrievable commitments of resources in the No Action Alternative would occur in the other four alternatives. However, the difference in magnitude would be commensurate with the level of mining. The reader is referred to the narrative in the No Action Alternative for the type of impacts that would occur in the remaining four alternatives.

No Action Alternative

The coal that is mined would be irretrievable, and 50% of coal that is mined by underground methods and 15% that is surface mined would be unrecoverable by present technology.

Some of 1,069 estimated fossils localities of the late Cretaceous, Crevase Canyon, Menefee, and Kirtland/Fruitland formations and associated data would be destroyed and irreversibly lost. The Kirtland/Fruitland contains an unparalled record of one of the most important episodes in history, the abrupt change from domination by dinosaurs to domination by mammals. Surface fossils impacted or removal through unauthorized, collection, vandalism, or destruction would be irreversibly and irretrievably lost.

Alteration of the present landscape in surface mined areas and the lowering of aquifers under surface and underground mined areas would be irreversible and irretrievable. Water consumed each year of the mining and reclamation operations would be irretrievably lost to other uses. Destruction of shallow ground-water sources (yielding water to shallow wells) through surface mining would be an irreversible commitment of this resource.

A few of the 542 predicted cultural sites would be destroyed and irreversibly and irretrievably lost. Most sites would be salvaged through excavation, however testing or further recordation would lose scientific value that may have been available with future archaeological techniques. Cultural resources impacted or removed through unauthorized collection, vandalism or destruction would be irreversibly and irretrievably lost.

Human fatalities and permanent injuries caused by traffic and mining accidents would be irreversible and irretrievable.

Opening up the region with paved roads and introducing a large-scale industrial economy would produce irreversible changes in traditional Navajo lifestyle.

Any gravesites and sacred areas that are destroyed would be irreversibly and irretrievably lost.

Bypass Alternative

Some of the estimated 1,340 fossil localities, and 707 to 730 cultural sites would be irretrievably lost.

Surface mining of scenic badlands on Bisti #4 and Bisti #6 tracts would irretrievably destroy the scenic, recreational and scientific values of these areas through alteration of unique natural land forms.

Minimum Surface Owner Conflicts Alternative

Some of the estimated 1,205 fossil localities, and 114 to 1,250 cultural sites would be irretrievably lost.

Target Alternative

Some of the estimated 2,469 fossil localities, and 1,356 to 1,647 cultural sites would be irretrievably lost.

Surface mining of scenic badlands on the Bisti #2, #4, and #6 tracts would be irretrievably destroy the scenic, recreational, and scientific values of these areas through alteration of unique natural landforms.

High Level Alternative

Some of the estimated 2,762 fossil localities, and 2,269 to 2,837 cultural sites would be irretrievably lost.

Surface mining of scenic badlands on the Bisti #2, #4, and #6 tracts would be irretrievably destroy the scenic, recreational and scientific values of these areas through alteration of unique natural landforms.

Surface Water

The specific impacts on surface-water resources for an individual coal tract cannot be adequately evaluated given the existing information;; however, the impacts can and will be addressed on a site-by-site basis during the evaluation of the applicant's mining and reclamation plan and prior to the granting of a permit to mine. The following description of general impacts is based on the assumption that the mine operators will comply with the regulations of the New Mexico Coal Surface Mining Commission (CSMS, Rule 80-1, Section 20-41 and subsequent sections) and other applicable State and Federal regulations.

In general, the potential impacts on surface-water resources are far less significant than the impacts on ground-water resources.

No Action Alternative

Surface-water quantity

The major impact on surface-water resources would be the destruction of natural drainage patterns by the removal of the overburden in the mined areas. Any existing stock tanks and playa lakes would also be destroyed. Surface runoff and streamflow that originate upstream from the mined areas would be diverted around the areas unless the mine operator obtains water rights. Runoff from precipitation falling on the disturbed areas would generally be impounded behind retention dams. Most of the impounded water probably would evaporate; sediments would tend to settle on the bottom of the pool and thus reduce infiltration into the soil. The decrease in area contributing surface runoff would reduce streamflow and recharge to the alluvium downstream from mining operation; however, the discharge of water from mine dewatering (treated to comply with effluent regulations) could cause increased flow and recharge downstream from underground mines. Extensive ground-water withdrawals at mines and the resulting loss in hydraulic head could slightly decrease ground-water discharge to the San Juan River, and thus decrease flow, and reduce spring discharge from the Chuska Sandstone (see Ground Water).

Changes in the amount of runoff from mined areas after reclamation would be dependent on the degree to which topography and water infiltration rates are changed. In general, the combination of the reduction of steep slopes, the elimination of badland areas, and the increase in surface permeability caused by the addition of planting medium and the establishment of vegetation would tend to decrease runoff volumes.

Shown and others (1981) evaluated the potential impacts of surface mining and reclamation at Tsosie Swale, a small basin in

the Chaco River drainage. Estimates of peak streamflow and runoff volumes following reclamation were 30 to 70 percent of the premining estimates.

Surface-water quality

The New Mexico Surface Coal Mining Commission Regulations require the use of the best available technology in the design, construction, and maintenance of diversion structures, sediment ponds, and treatment facilities to prevent or minimize adverse changes in water quality. In no case shall Federal and State water quality statutes, regulations, standards, or effluent limitations be violated (Section 20-41 (c)).

During mining, streamflow originating upstream from the disturbed area generally would be diverted around the area; thus, the quality would not be affected. Surface runoff from the disturbed areas would be impounded in sediment ponds and either evaporate or be treated to comply with appropriate regulations before release to a stream channel. After mining, the sediment ponds and treatment facilities would be maintained until the disturbed area has been reclaimed unless the mine operator can demonstrate that the runoff from the mined area is of as good as or better quality than the water entering the mined area.

Data about water quality following mining and reclamation are very limited. The data available are from reclamation plots at the San Juan Mine near Waterflow and the Navajo Mine near Fruitland (Appendix Table B-10). The analyses are from samples of surface runoff collected immediately downslope from the plots; it is not known if the runoff reached any stream channels. The concentrations of most chemical constituents were well within the ranges present in streamflows. The pH values generally were slightly lower and some trace element concentrations were higher than average values. The April 1982 samples from the San Juan plots had much greater than normal concentrations of some constituents. Presumably the precipitation was of sufficient intensity to expose spoils to runoff.

The most significant potential impact of surface mining and successful reclamation on water quality would be a decrease in the sediment yield of the disturbed areas. The same factors responsible for decreasing surface runoff (see preceding section) would tend to decrease the amount of sediment these areas contribute to streamflow. In their evaluation of potential mine tracts, Summer (1981) and Shown and others (1981) provide detailed discussions leading to their predictions of significant reductions in sediment yield following mining and reclamation.

The preceding description has addressed the general long-term impacts of mining and reclamation. The possibility of short-term, though very significant, impacts also exists. Accidental spills of

liquid or solid waste materials at the mining operations could cause serious contamination of surface-water supplies. Precipitation events exceeding the specified design criteria for impoundments and diversion structures could cause very large peak flows of water containing abnormally high concentrations of chemical constituents and suspended sediment.

Other Alternatives

The general impacts on surface water caused by the other alternative actions are the same as those described for the No Action Alternative. The nature of the impacts do not change; the magnitude of the impact is proportional to the amount of surface area disturbed. During mining and reclamation, the larger the area disturbed the less the area contributing surface runoff and the larger the decrease in streamflow and sediment. After mining, the larger the area successfully reclaimed the greater the reduction in sediment yield and streamflow. Increases in the number of mining operations may increase the possibility of accidental contamination of surface water and of failure of impoundments and diversion structures.

MITIGATING MEASURES

Strict compliance with applicable State and Federal regulations should obviate the need for any additional mitigating measures.

RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

The only existing use of surface water in the coal tract areas is for livestock and wildlife watering. Any existing water supply to which the surface owner has water rights would be replaced as part of the mine reclamation. Surface-water resources in the area are fully appropriated; water for mining operations would have to be obtained from those holding water rights.

CUMULATIVE IMPACT SUMMARY

Introduction

This section is a summary of findings from the Cumulative Overview study. These findings are presented formally in the Cumulative Overview, and are supported by data and analytical descriptions presented in another document called Cumulative Overview Technical Report (BLM 1982). The cumulative overview analyzes the significant cumulative impacts of this EIS and two other proposed actions, they are: the Bisti, De-na-zin and Ah-shi-sle-pah Wilderness Study Areas and the New Mexico Generating Station. Further detail on the other two individual proposed actions and their direct impacts is available in the respective EISs.

This summary is organized into three subsections: a review of the proposed actions, description of the portions of the environment affected by cumulative impacts and a presentation of the cumulative environmental consequences.

Proposed Actions

San Juan River Regional Coal EIS

Chapter 1 of this EIS provides a complete description of the Target Alternative.

New Mexico Generating Station EIS

PNM proposes to acquire necessary right-of-way permits to construct a 2000-megawatt (MW) coal-fired electric generating plant approximately 35 miles south of Farmington, New Mexico, in San Juan County. Four 500-MW units are proposed, with the earliest unit possibly being needed by 1990 and the other three units being needed through the 1990s. For the environmental analysis, the four units were assumed to be needed in 1990.

Bisti, De-na-zin, and Ah-shi-sle-pah Wilderness Study Areas EIS

The Wilderness Study Areas (WSAs) proposal involves three Wilderness Study Areas in the San Juan Basin, two of which are recommended for designation as Wilderness Areas, and both of which are close to NMGS. These WSAs are Bisti and De-na-zin; together they encompass about 24,000 acres located north and east of NMGS. These WSA lands overlap in places with some PRLA tracts, and are close to other San Juan River Regional Coal (SJRRC) tracts.

Affected Environment

As used in the Cumulative Overview, cumulative impacts refer to "new" (previously undiscussed) information and are defined to be of two types:

1. Significant impacts (from individual EISs) that when analyzed cumulatively show increased levels of magnitude of severity from those presented in the EISs.

2. Non-significant impacts that cumulatively would be considered significant at sensitive or important locations.

Based on a preliminary analysis of the interactive effects of the proposed actions, six resources were identified for further analysis. The affected resources groups are discussed briefly below.

Air Resources

Air quality studies were concerned with the potential increase in concentrations of total suspended particulates (TSP). In a few small areas close to both NMGS and SJRRC mines, there was concern that low-level dust concentrations from power plant and mining sources would combine to yield concentrations that would exceed prevailing standards. The study area for air quality was derived from dispersion modeling that delineated overlapping areas of measurable concentrations from both NMGS and SJRRC; all mine locations within 25 km of NMGS were identified to be included in the analysis.

Cultural and Paleontological Resources

The San Juan Basin presents an extensive body of physical evidence of a culture history dating back 10,000 years or more. Cultural resources which could be affected are primarily archaeological sites; other resources (e.g. gravesites or sacred areas) that have cultural significance to American Indian groups are also potentially affected. Paleontological resources consist mainly of extensive fossil beds which are internationally known for their richness and diversity. Together, the cultural and paleontological resources of the San Juan Basin provide unusual opportunities for research and interpretation because of their abundance, and regional extent. The study area includes all of the San Juan Basin and extends into neighboring areas within one day's drive (100 miles) of larger communities, particularly Farmington.

Visual Resources

The concern of cumulative impact analysis for visual resources is increased visual contrast, as seen from a number of key viewing points. Key elements of the affected environment are the viewing points (within WSAs designated park and recreation areas, highway access points, and other scenic areas), the expected modification of the landscape (addition of structures, or changes to elements of the landscape), and areas where visual contrasts from more than one project are visible from the selected viewing points. Only NMGS and SJRRC would cause modification to the landscape. . Designating Bisti and De-na-zin wilderness areas would preserve the landscape quality.

The study area for cumulative visual impacts are areas close to NMGS facilities and SJRRC tracts that are visible from key viewing points or next to high quality scenic areas. The critical viewing distance from NMGS facilities or SJRRC tracts depended on the degree of visual contrasts, associated with a specific feature of the project (e.g., stacks transmission line mine pit).

TABLE 3-22

SUMMARY OF AFFECTED RESOURCES CONSIDERED IN THE CUMULATIVE OVERVIEW 1/

Resource	Study Area	Impact Topic	Indicator of Significance	Findings
Air Quality	12.5 km radius from NMGS, overlapping TSP contours from NMGS and SJRRCL. All mine locations within 25 km of NMGS were identified to include in the analysis.	Increase in total suspended particulate (TSP) concentrations from fugitive dust and stack emissions.	Concentrations ($4g/m^3$) in excess of any 24-hour or annual standard.	One small area close to Bisti mine No. 1 may experience TSP concentrations in excess of a standard, The potential for additional concentrations in excess of standards may occur in a worst-case situation in which a PRLA mine is located close to another mine (i.e. 1 km or less).
Cultural and Paleontological Resources	Resources within 100-mile radius of greater Farmington area.	Primarily, indirect effects of increased exposure of resources to an increased population (i.e. vandalism, commercial looting, inadvertent damage) as well as deliberate conservation and interpretation of some resources.	Due to large numbers of sensitive resources and their prescribed significance (36 CFR 60.6, PL 96-550, AIRFA, etc.), all adverse cumulative impacts are considered to be significant.	Impact include conservation of some resources through land withdrawal, and preservation of important information through its acquisition and synthesis in connection with mitigation. Consumption of the resource base through research and mitigation activities, and loss of some resources to purposive or inadvertent disturbance of sites by a larger population. Eventual surface disturbance of 140/sq. mi. with a potential of 13.5 sites per square mile.
Visual Resouces	Overlapping portions of areas within selected visual ranges (3-10 miles) of NMGS and SJRRCL project features which also are visible from key viewing points (primarily from WSAs, designated park and recreation areas, highway access points, and other scenic areas).	Degradation of scenic quality wihtin the critical viewing distance from WSAs and other regionally important locations (e.g., cultural sites), due to landscape modifications from combined NMGS and SJRRCL actions.	Numerical contrast rating thresholds in the BLM VRM system (exceedence of any established threshold was considered to be significant).	Impacts from seven key viewing points, most significantly along the northern side of Chaco Culture National Historical Park, from within the WSAs, and at highway access points to these areas. Most are nationally significant or potentially so. In 1981, 4000 visitors visited Pueblo Alto in CCNAP. An annual increase of 17 percent is being recorded at Pueblo Alto.

TABLE 3-22 (Continued)

Resource	Study Area	Impact Topic	Indicator of Significance	Findings
Recreation/ Wilderness	Recreation areas and all WSAs (9 acres) within 100-mile radius from Farmington and Grants.	Loss or degradation of recreation or wilderness resources or their essential characteristics, primarily as a result of an increased regional population and its consequent demand for and use of these resources, or their close proximity to SJBAP actions.	Loss or degradation of resource areas from crowding of recreation facitlities (based on unit-use standards), any degradation of essential environmental qualities (scenery, noise) associated with high quality recreation and wilderness experiences.	Degradation of the quality of wilderness experience in Bisti and De-na-zin WSAs, overcrowding of recreation areas close to Farmington and Grants, and degradation in the quality of dispersed recreation activities in the region.
	The study area for noise impacts included Bisti and De-na-zin WSAs, and mines and roads within 20 km of NMGS.	Increased noise levels from blasting, haul trucks, and employee-related travel.	Increment of 9 dB(A) above baseline noise levels in WSAs.	Increases in hourly noise levels greater than 9 dB(A) over baseline is predicted at the boundary of De-na-zin WSA, as a result of worker and haul traffic in excess of 700 vehicles per hour on C-15.
Transportation	Roads and railroads linking Farmington area communities with Gallup and Grants-area communities. Includes all roads and railroads that provide access to NMGS and SJRRCL components.	Increased traffic volumes and safetly hazards on existing roadways.	Increase in peak volume greater than peak volumes estimated for NMGS or SJRRCL individually, and close to, or greater then, designed roadway capacity or surface structure tolerance.	Significant overloading of NM 371 between Farmington and NMGS site, with an increase in average daily traffic from 2,540 in 1977 to 6,335 in 1992. This would be just below the maximum vehicle capacity for a 2-lane highway.
Social and Economic Resources	Communities in the greater Farmington area (Farmington, Aztec, Bloomfield, Flora Vista, Lee Acres, and Lower Valley) where allocation of the combined increases in population from NMGS and SJRRCL have been made.	Employment, population growth, housing, community infrastructure and services, and public finances.	Ten percent annual growth rate or greater in population or public revenue.	Significant population growth in 1985-86, significant expansion of regional economy from 1985-1995, excess housing demand in mid '80s and early '90s, shortfall of projected human services to demand.

TABLE 3-22 (Concluded)

Resource	Study Area	Impact Topic	Indicator of Significance	Findings
Social and Economic Resources	Communities in the greater Farmington area (Farmington, Aztec, Bloomfield, Flora Vista, Lee Acres, and Lower Valley) where allocation of the combined increases in population from NMGS and SJRRCL have been made.	Employment, population growth, housing, community infrastructure and services, and public finances.	Ten percent annual growth rate or greater in population or public revenue.	Significant population growth in 1985-86, significant expansion of regional economy from 1985-1995, excess housing demand in mid '80s and early '90s, shortfall of projected human services to demand.
			Shortfall of projected public revenue to meet projected demands, or inability of private sector to meet such demands.	San Juan County would experience a slight deficit (approximately $17,000) in overall operating funds in 1984-85, and surpluses thereafter which could reach $2.6 million in 2000.
			Demand for community facilities and services, education, health and human services, police and fire protection, recreation) in excess of existing and projected supply.	Direct impacts (from mining) would occur to 125 residences, 34-44 known gravesites and 7 known sacred sites.
	Portions of San Juan Basin occupied and used primarily by the Navajo.	Opportunities to pursue traditional American Indian values and lifestyles.	Reduction of opportunities to pursue traditional values and livestyles.	Unquantified, but probably significant reduction in opportunities to pursue traditional lifestyles. A maximum of 20,000 Navajos might be affected.

1/ The impacts of resources listed in this footnote as analyzed in the individual EISs dis not meet the requirements for futher analysis in the CO, i.e., the combination of identified significant impacts did not show an increased level of magnitude or severity nor did the combination of non-significant impacts produce an aggregate significant impact.

A summary of these resources together with a brief notation of their combined impacts follows:

Soils - Total acres disturbed which would result in decreased productivity is 70,347. This includes 31,970 acres PRLA's, 35,977 acres for Target Level and 2,400 acres for NMGS.

Water Resources - The total projected water use of the PRLA's is 12,850 acre feet of ground water, for the Target Level Alternative 3,700 acre feet of ground water and for NMGS is 35,000 acre feet of surface water for a grand total of 51,550 acre feet.

Vegetation - The total of vegetation disturbed during mining would be for PRLA's 31,718 acres Target Level Alternative 35,977 acres and for construction and operation of NMGS 2,400 acres.

Livestock Grazing - The total AUM's lost during mining would be for PRLA's 4,169 AUM's, Target Level Alternative 5,798 AUM's (loss would occur until reclamation is completed), and for NMGS 160 AUM's.

Wildlife - The total acres to be excluded from wildlife use until after reclamation is completed would be for PRLA's 32,423 acres and Target Level Alternative 35,977 acres for a total of 68,400 acres. Total acres of wildlife habitat used by NMGS is 2,400 acres. The grand total of wildlife acres disturbed over the life of the proposed actions is 70,800 acres.

Species of High Federal Interest - For PRLA's coal mining would impact one prairie falcon, five ferruginous hawks and one golden eagle nests. For the Target Level Alternative coal mining would impact one prairie falcon, seven ferruginous hawks and two golden eagles nests and 200 acres of elk and deer habitat. For NMGS no raptor meeting sites would be removed by project construction of the power plant and would not effect deer or elk critical habitat. The proposed transmission lines would have a potential impact on two raptor nest within a one mile wide corridor but has no potential impact on critical mule deer or elk critical winter range. The proposed water delivery system would have a potential impact on mule deer critical winter of 35 acres at the intake site and of one acre along the pipeline.

Threatened and Endangered Species - For the SJRRCL area which include PRLA and the Target Level Alternative, no habitat for federal threatened or endangered wildlife species has been identified in the biological assessment prepared for Section 7 Consultation (Endangered Species Act of 1973) with the U.S. Fish and Wildlife Service. For the NMGS powerplant no threatened or endangered species would be impacted because the species of concern do not occur in areas that would be disturbed by construction activities. For operation/maintenance and abandonment of NMGS power plant there is a potential that the greenback cutthroat trout and the mancos milkvetch may be affected by acid rain. Both the proposed water delivery pipeline system and the transmission line T-5 have the potential for impacting one mesa verde cactus on each line.

Land Use - For PRLA's removal or relocation of nearly 379 acres of rights-of-way would occur, while for the Target Level Alternative an estimated 363 acres would be affected. The total for both actions is 742 acres. Rights-of-way relocation is normally accomplished by agreement between the right-of-way holder and the coal company. For NMGS, from the BLM perspective, use of lands for the proposed NMGS would not result in any conflict with existing land use controls and constraints. From the Navajo perspective, use of this land for the proposed NMGS could be perceived as a potential conflict with Navajo tribal plans and policies for use of these lands, in that this action would preclude their option to acquire these lands as part of the settlement for the Navajo-Hopi land dispute resolution.

Recreation and Wilderness Resources

In addition to the Bisti and De-na-zin WSA, there are seven other WSAs and other recreation areas (Chaco Canyon, national forests and state parks) within a day's drive of the larger communities (e.g. Farmington, Albuquerque, Grants, and Gallup). Cumulative impact analysis was concerned with the potential loss or degradation of these recreation and wilderness areas, because of the increased regional population and demand for use of these areas. The study area focused on the San Juan Basin, but also considered recreational opportunities within 100 miles of Farmington and Grants.

Noise impacts were evaluated with respect to the WSAs. The concern was that the noise from SJRCC mines and NMGS would be audible in the WSAs and would degrade the wilderness experience of the users. The study area included the Bisti and De-na-zin WSAs, and roads and mines within about 20 km of NMGS.

Transportation

Cumulative impact analysis focused on increased traffic volumes due to the combined work forces of NMGS and SJRRC, and whether the area's existing roads could handle these higher volumes efficiently and safely. The study area was based on a projection of commuter routes. The roads of greatest interest were NM 371 from Farmington south to county road C-14, and portions of NM 44. A few municipal roadways in the Farmington area were considered also.

Social and Economic Conditions

The NMGS and SJRRCL projects would produce changes in the region's population and potential economic structure. These changes, would alter population and economic characteristics, and the levels of demand for housing, infrastructure, and services. The magnitude and timing of impacts change when the construction and operation periods for NMGS and SJRRC are analyzed cumulatively.

Preliminary analysis showed that the greatests increase in population due to NMGS and SJRRC was in the Farmington area (Grants and Gallup are expected to be affected primarily by SJRRCL and not NMGS). Therefore the study area was limited to Farmington-area communities.

ENVIRONMENTAL CONSEQUENCES

For all of the resources considered, cumulative impacts would be more severe than the simple sum of impacts identified in the individual proposed actions. Cumulative impacts were determined to be significant for all resources. Table 3-22 is a summary of findings from the cumulative impact analysis. Brief descriptions of the cumulative impacts assessed for each resource are presented below.

Air Quality

Increases of ambient total suspended particulate (TSP) concentrations resulting from mining operations were projected by dispersion modeling for each mine. This was added to the modeled concentrations from NMGS, and then added

to background levels. The results of this analysis are below all applicable national ambient air quality standards for TSP, and the 24-hour New Mexico TSP standard. Total predicted levels of TSP are in excess of the annual New Mexico standard (60 ug/m^3) in a small area within 2 kilometers from one mine boundary. It is not known at this time whether such areas would be classified as "ambient air" (i.e., air to which the general public has access), since PRLA mine boundaries are not defined yet. However, under worst case assumptions, exceeding the annual New Mexico standard would constitute a significant impact. Significant TSP impacts were found in the SJRCC EIS. Beyond this one area, the TSP levels related to NMGS did not combine with TSP levels for SJRRC to produce significantly different effects.

Development of coal resources will be accompanied by growth in population and the general economy of the region. This will mean more motor vehicles and more motor vehicle emissions of air pollutants, in particular carbon monoxide, hydrocarbons, nitrogens oxides, and lead.

Evaluation of the air quality impacts resulting from this growth depends primarily upon population growth projections. These projections will be used for evaluating the associated indirect air quality impacts.

Cultural and Paltontological Resources

The following impacts were identified:

1. In designated wilderness areas or in other special areas (e.g. ACECs) the existing cultural and paleontological resources will be conserved by allowing research under certain circumstances.

2. Significant research information would be obtained about the cultural and paleontological resources of the San Juan Basin either through mitigation studies, or through resources discovered during construction or operation of NMGS and SJRRC mines.

3. Some cultural and paleontological resource will be destroyed this will increase the significance of remaining resources and traditions. Information gathered may be of less value to future researchers with unknown research interests, or improved techniques.

4. There would be an increase in the loss of cultural and paleontological resources through vandalism, pothunting, and natural erosion due to increased visitation.

Visual Resources

Based on visual contrast ratings of landscapes that would be modified by NMGS and SJRRCL features, and viewed from high-quality scenic areas, changes in visual resources were compared to Visual Resource Management objectives (according to the BLM-VRM system) for different classes of resources. There would be significant degradation of visual quality as viewed from two locations on the northern side of Chaco Culture National Historical Park (Pueblo Alto and

Pueblo Pintado), and a reduction in visual quality from several locations within Bisti and De-na-zin WSAs (NMGS and SJRRCL features will be visible in many viewing directions from within these areas). There would also be a high visual contrasts on highway approaches to both the WSAs and Chaco Cultural National Historic Park (CCNHP). Some mitigation may be achieved by softening the visual contrasts resulting from power transmission lines and surface mines, through design and cosmetic treatments.

Recreation and Wilderness Resources

Based on the projected increase and distribution of regional population, estimates were made of the probable demand for and participation in several recreation activities. It was assumed that high-quality recreation areas close to Farmington would be affected first, and that user preference of similar recreation resources would generally diminish with distance. Several recreation areas were predicted to become overcrowded, and thus susceptible to degradation. In addition, direct impacts to recreation and wilderness areas close to NMGS and SJRRCL were considered, in relation to the findings of other resource analyses (visual resources, noise, etc.).

The assumption that users would seek more distant but equivalent recreation experiences if nearby areas were crowded is less likely for the cumulative impact analysis than when one project was considered. Recreation use derived from SJRRCL would tend to concentrate in the southern San Juan Basin, while users related to NMGS would tend to seek recreation areas nearer to Farmington. When both projects are considered together, all recreation resources in the Basin would be sought after equally with few better prospects for a quality recreation experience available except at more remote locations. The most seriously overcrowded areas in the Basin are likely to be Navajo Lake State Park, Angel Peak Recreation Area, Bluewater Lake State Park, and the CCNHP.

The combined noise impacts of truck traffic (from both NMGS and SJRRC mines), employee-related traffic from all projects, and blasting at the mines, was considered in relation to users of the Bisti and De-na-zin WSAs. Most of the people subject to project-related noise would be employees; noise impacts to employees are covered by environmental health and safety regulations. It is assumed that "on-site" noise levels will not be significant by regulatory definition; or would be mitigated at the receptor.

Increased hourly noise levels greater than 9 dB(A), which roughly represents a doubling of perceived noise, were considered to be significant. Based on this definition, significant noise impacts are projected to occur at the boundary of Bisti WSA closest to NM 371, and the boundary of De-na-zin closest to county road C-15. From some locations within these WSAs, increased noise levels greater than 9 dB(A), resulting from traffic along these two mentioned roads, are projected to occur. These noise impacts could be lessened by reducing the number of vehicles, or by routing traffic away from sensitive areas.

Some degradation in the quality of wilderness experience due to visual degradation and noise is expected within both the Bisti and De-na-zin WSAs.

Transportation

Traffic volumes on roadways in the San Juan Basin were projected by combining commuter volumes developed in the analysis of social and economic conditions, and truck volumes estimated in the noise analysis. These data were assembled for specific roads (according to projected commuter routes and mine locations) and for each year of operation of the NMGS and SJRRCL projects. Since transportation effects of either NMGS and SJRRCL would be significant any joint increase in projected volume over previous estimates was considered to be significant.

The most significant impact is projected to occur on NM 371 between Farmington and the NMGS plant site, where traffic volumes are likely to be about 100 percent greater than projected by the State Highway Department, and about 60 percent over standard maximum capacity for a roadway of that size and duty type. Since the magnitude of the cumulative impact is so great, consideration should be given to expanding the roadway from 2 lanes to 4 lanes.

Social and Economic Conditions

Cumulative impact analysis focused on two topics: rapid growth in the region, and the ability of communities to respond in a timely fashion with housing, services, and facilities; and decreased opportunities for the pursuit of traditional American Indian values and lifestyles. An increase in employment opportunities resulting from simultaneous development and operations of NMGS and SJRRC would cause rapid growth and associated problems. Together, the two projects would add approximately 9000 direct jobs at peak, generating about twice that number of indirect jobs. About one-third of the population associated with these jobs would seek residence in the southern part of the region (centered on the Grants-Gallup axis), and would primarily be a result of SJRRC mining activity. Therefore, the cumulative impact analysis focuses on communities affected by the joint employment opportunities of both NMGS and SJRRCL; these communities are located in the Farmington area.

Total direct employment from NMGS and SJRRCL would peak at 8,977 jobs in 2019. Approximately 6,000 of these jobs would be available to residents of the area, plus an additional 12,000 to 13,000 indirect employment opportunities.

The greatest population inflows would occur in study area communities in 1995 and 1996. At that time Farmington population could reach 56,600 with the proposed actions for a 26% increase above levels without the proposals. Aztec and Bloomfield would each grow 1,700 for percentage increases of 23% and 26% respectively with the proposals.

Consequent to the creation of employment opportunities affecting these communities would be increases in personal income and sharply increased needs for housing, infrastucture, and human services. The greatest annual cumulative need for housing would occur in 1986 when an additional 2,550 units would be required as a result of project related population growth.

Public finances would be affected in response to increased needs and increased public revenues from the new population. Traditional Navajo values and lifestyles would be affected through changing population composition, increased income, and increased mobility.

The significant impacts were estimated to be:

1. Population growth in Farmington in 1985-86 at rates greater than 10 percent per year. These growth rates are likely to be stressful to community resources, and may cause adverse social and economic conditions for several years beyond the periods of fastest growth.

2. Significant expansion of the regional economy from the mid-1980s through the 2020s, as measured in terms of employment, income, and public revenue. San Juan County would experience a slight deficit ($17,000) in overall operating funds in 1984-85 and surpluses thereafter which would reach $2.6 million in 2000.

3. Excess housing demand in the Farmington area in the 1985-1995 period.

4. Potential inability of human service agencies to keep pace with demand.

5. Unspecified but potentially significant impacts to American Indians (especially Navajo), generally related to decreased opportunities to pursue traditional lifestyles.

CHAPTER 4
CONSULTATION AND COORDINATION

CHAPTER 4

CONSULTATION AND COORDINATION

SCOPING MEETINGS

Beginning early in 1981, the BLM conducted a series of sixteen scoping meetings with other federal, state and local agencies, the Navajo Tribe, and the general public. The purpose of these meetings was to gather information regarding the concerns of these groups on the various projects that are part of the San Juan Basin Action Plan (SJBAP). This plan includes this San Juan River Regional Coal EIS, and was developed by the BLM to ensure a coordinated approach to handling the projects.

An initial mailing was made to over 3,000 agencies and individuals to distribute information about the proposals and to announce scoping meetings to the public. A follow-up mailing of nearly 2,000 letters was made to those who expressed an interest, reminding them of the meetings. These meetings were announced in the Federal Register, news releases, and radio spots in both the English and Navajo languages.

The scoping meetings held for these projects were as follows:

Agency Meetings

Albuquerque (Federal Agencies)	Monday, January 12, 1981- Albuquerque Convention Center. Eleven representatives of federal agencies including the National Park Service, Geological Survey, and Fish and Wildlife Service attended.
Santa Fe (New Mexico State Agencies)	Tuesday, January 13, 1981 - Sweeney Convention Center. Participants included the State Planning Division, Natural Resources Department, State Highway Department, State Engineer, and the Institute for Regional Education.
Farmington (County and Local Governments)	Thursday, January 15, 1981 - Farmington Civic Center. Twelve representatives of San Juan County, Farmington School District, City of Farmington, and the local Bureau of Indian Affairs office attended.

Indian Meetings

Crownpoint	Monday, January 19, 1981 - Community School House.
Lake Valley	Tuesday, January 21, 1981 - Community School House.
Huerfano	Wednesday, January 21, 1981 - Community School House.
Pueblo Pintado	Thursday, January 22, 1981 - Community School House.

Approximately 300 Navajo Indians attended these sessions. The presentations were done in Navajo.

Public Meetings

Albuquerque	Tuesday, February 3, 1981 - Albuquerque Convention Center, 145 participants.
Gallup	Wednesday, February 4, 1981 - Gallup Holiday Inn, 33 participants.
Farmington	Thursday, February 5, 1981 - Farmington Civic Center, 81 participants.
Taos	Monday, February 23, 1981 - Kachina Lodge, 58 participants.
Dulce	Wednesday, February 25, 1981 - Jicarilla Apache Tribal Council Meeting Room. Twenty-three representatives from the Jicarilla Apache Tribal Council, Jicarilla Tribe, and Bureau of Indian Affairs attended.

Summary of Scoping Meetings and Written Comments

The major issues raised at the scoping meetings included questions of procedure, purpose, need for leasing coal, leasing targets, Department of Energy (DOE) production goals, and potential coal markets in the San Juan Basin. Major resource concerns centered around air quality, water quality and quantity, reclamation potential, paleontology, archaeology, wilderness, social Navajo issues (religion, occupancies, sacred sites, gravesites, influx of non-Navajos into the area, and health and safety on the Navajo Reservation), socio-economics (jobs, timing of jobs, revenue, effects on community infrastructure), increased traffic on roads, and wildlife. Navajo, local, and state governments also expressed an interest in being kept informed and included in the EIS process, and a need for more public meetings was voiced.

A more detailed description of the major issues is included in Chapter 1.

ISSUES NOT ADDRESSED IN THIS EIS

Certain issues are beyond the scope of this EIS, or the jurisdiction of the BLM, or are dealt with in other environmental documents. A few of these isues are listed below.

1. It was suggested that this EIS analyze the impacts of making more efficient use of existing energy sources and of obtaining alternate energy sources. The issue of federal coal leasing and development to meet national energy needs was previously addressed in the Final Environmental Statement: Federal Coal Management Program (USDI, BLM 1979a). Development of coal does not preclude the emphasis placed on conservation and alternate energy sources.

2. It was also recommended by the public that this EIS identify existing and potential projects in the region that would add to the impacts from coal mining. Federal projects that have existing approval and are located in or near Preference Right Lease Applications (PRLAs) and competitive coal lease tracts are analyzed in Chapter 3 of this EIS.

3. The public feels that the allocation and availability of water for all uses in the region should be examined. This issue is beyond the scope of this EIS. Allocation and availability of water in the region is determined by the New Mexico State Engineer.

4. It was recommended that coal market and coal transportation analyses be prepared prior to leasing. These analyses would unnecessarily duplicate other efforts. The need for leasing addressed in this EIS is based in part on production goals from the DOE; these goals are the result of a process that is essentially a market analysis. The DOE goals include consideration of transportation costs and capabilities for developing coal in the western United States.

CHACO/SAN JUAN MANAGEMENT FRAMEWORK PLAN

This BLM planning effort has benefited from a high level of public participation from the outset. Comments on the implications of coal-related land use planning in the Chaco Planning Unit have been provided by numerous groups and individuals at the national, state, regional, and local levels. Public participation activities sponsored by the BLM have also been used to obtain input from rural residents of the potentially strippable coal zone. Because these people are primarily Navajos living in relatively isolated circumstances, who to some degree are ineffectively represented by conventional political systems, some parts of the public involvement effort were tailored to their needs.

During earlier stages of the planning process, "open houses" were held at Pueblo Pintado, Nageezi, Crownpoint, Lake Valley, Gallup, Grants, Farmington, and Albuquerque to receive guidance from the public. Field interviews were conducted, and an active outreach program was carried out over a 16-month period, responding to requests from groups for presentations on the issues involved. The BLM also distributed an information sheet on work in progress and a pamphlet ("Coal in the Chaco-San Juan") that included a mail-back comment form.

Special opportunities were provided to allow public input on what the BLM's land use recommendations should entail. Called "public brainstorming sessions," these meetings produced some suggestions that have been reflected in the BLM recommendations presented here.

Opportunities for public review of this planning effort in its later stages were also established, including open houses in Pueblo Pintado, Lake Valley, Huerfano, Farmington, Albuquerque, and Taos. Attendance at these open houses was approximately 1,300 individuals; 730 written comments were also received. Much of this public input was responsible for the recommendations and changes made during the land use planning process.

COOPERATING AGENCIES

Opportunity for early involvement and cooperation in the environmental process was provided to numerous agencies. This involvement occurred through formal agreement or via an informal information exchange. The federal (Department of the Interior) agencies that have been contacted include the following: Bureau of Indian Affairs (BIA) (formal agreement), Fish and Wildlife Service (FWS), Minerals Management Service (MMS), Office of Surface Mining (OSM), and U.S. Geological Survey, Water Resources Division (USGS) (formal agreement).

Letters were sent to each of these agencies requesting specific information. The letters requested that a single named contact be established for each agency; this contact has been kept informed on the development of the EIS and thus has acted as an information channel for those agencies.

The USGS submitted information on surface water and some data on underground water. The BIA's input was mostly on a consultation basis regarding the unsuitability of certain lands for coal mining, wildlife, Navajo concerns, and cultural resources. The BIA also provided maps and information about grazing allotments, forage allocation, allotment owners, range improvements and surface ownership in the regions of competitive coal leasing. The MMS provided coal resource information and, along with the OSM and the FWS, has provided input into this EIS through review and informal consultation as requested.

SURFACE OWNER CONSULTATION

Under the terms of the Surface Mining Control and Reclamation Act of 1977 (SMCRA) (30 USC 1201; 91 Stat. 445), a qualified surface owner must consent to the mining of federal coal by surface methods when this coal underlies his/her privately owned surface. The Preference Right Lease Application (PRLAs) predate passage of SMCRA, so surface owner consent is not required for surface mining on the PRLAs. However, this consent is required on the competitive tracts. As an initial step in determining the views of potentially qualified surface owners, the Farmington Resource Area Office mailed out 1,143 certified letters to owners of 130 individual allotments. (Refer to Appendix H for the text of this letter.) Fifty-four of these allotments are held in individual ownership and 76 are held in multiple heirship.

In a letter to the BLM dated November 21, 1981, the Chairman of the Navajo Tribal Council stated that the Council's position is that the Navajo Nation fulfills the requirements as a qualified surface owner for trust and fee lands of the Navajo Nation and for lands on which the Nation holds state or federal grazing leases. The Council has also taken the position that Navajos residing on lands withdrawn for Indian use under P.L.O. 2198 (refer to the Glossary) are qualified surface owners. The BLM State Director wrote a response to this letter on December 24, 1981, explaining that neither the tribe nor individual Navajos living on P.L.O. 2198 lands were qualified surface owners under the definition of 43 CFR 3400.0-5 (1980).

Various views towards proposed surface mining have been expressed in writing by individual Navajos and Navajo governmental bodies, some of whom may be found to be qualified surface owners within the meaning of SMCRA. The BLM has received 240 responses to the certified letters that were mailed. Of this number, 180 reflect a willingness to allow the federal government to include their lands for future coal development, 41 oppose the inclusion of their lands, and 19 are unsure. The Navajo Tribe has refused consent for surface mining. Seven chapters have also expressed opposition, including Little Water, Nageezi, Huerfano, Torreon, Lake Valley, Ojo Encino and Pueblo Pintado, and a similar position has been expressed by the Chaco Lejin Energy and Resource Committee.

REVIEW OF THE DEIS

Comments on the DEIS are being requested from the government agencies listed in Table 4-1 as well as special interest groups and members of the general public.

Public Comments and Responses

This section, to be prepared for the Final Environmental Impact Statement, will summarize the comments received on this Draft Environmental Impact Statement. Responses to these comments will also be included.

LIST OF PREPARERS

Table 4-2 lists preparers of this DEIS, including report writers and support personnel.

TABLE 4-1

DOCUMENT RECIPIENTS

Federal Government

Department of Agriculture
- Soil Conservation Service
- U.S. Forest Service

Department of the Army
- Corps of Engineers

Department of Energy

Department of Housing and Urban Development

Department of the Interior
- Bureau of Indian Affairs
- Bureau of Mines
- Bureau of Reclamation
- Minerals Management Service
- National Park Service
- Office of Surface Mining, Reclamation and Enforcement
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

Department of Labor

Department of Transportation

Environmental Protection Agency

Tribal Government

Navajo Nation

Presidents, Navajo Off-Reservation Chapters
- Crownpoint
- Huerfano
- Lake Valley
- Little Water
- Nageezi
- Ojo Encino
- Pueblo Pintado
- Torreon

Director, Navajo Tribal Land Administration

Local Government

San Juan Regional Committee

County Commissions
- McKinley County
- Sandoval County
- San Juan County

Local Government (Cont'd)

McKinley County
- Planning Department
- Soil and Water Conservation District

Sandoval County
- Planning Department
- Soil and Water Conservation District

San Juan County
- Planning Department
- Soil and Water Conservation District

State Government

State of New Mexico

Bureau of Mines and Mineral Resources

Commerce and Industry Department
- Economic Development Division

Department of Finance and Administration
- Planning Division
  - Coordination/Clearinghouse Bureau
- Historic Preservation Bureau
  - State Historic Preservation Officer

Energy and Minerals Department
- Mining and Minerals Division
  - Coal Surface Mining Bureau

Governor Bruce King

Health and Environmental Department
- Environmental Improvement Division

Highway Department

Land Office

Natural Resources Department
- Department of Game and Fish
- Soil and Water Conservation Division
- Water Resources Division
  - State Engineer

Other States

Arizona Clearinghouse
Colorado Clearinghouse
Utah Clearinghouse

TABLE 4-2

LIST OF PREPARERS

Report Writers/Reviewers

Name	Assignment	Education	Experience
Richard Watts	Team Leader, Topography, Noise Geology, Mineral Resources	BS Wildlife Science	NPS - 3 years - Park Ranger and Naturalist; BLM 10 years - Range Conservationist, Wild Horse and Burro Specialist; Watershed Specialist; Bisti Project Supervisor
Lee Larson	Technical Coordinator	BS Forestry/Recreation	BR 1 1/2 years - Bio. Tech; BLM - 2 years - Natural Resource Specialist; 3 years - Outdoor Recreation Planner, 1 1/2 years Supervisor Planning and Environmental Coordinator
Elizabeth Hummer	Office Manager	BS Wildlife Science	BLM - 4 years - Planning and Environmental Specialist
Chris Anderson	Air Quality, Climate	BA Zoology, MA Microbiology	FWPCA - 5 years - Aquatic Biologist; BR 5 years - Environmental Specialist; BLM - 5 years, Air Quality Specialist
Teresa Conner	Blasting	BS Mining Engineering and Geological Engineering	MMS - 1 year
Steve Craigg	Hydrology (Ground Water)	BS Geology MS Geology	USGS - 2 years - Hydrologist; BLM - 1 year Hydrologist
Peggy Gaudy	Cultural Resources	BS Anthropology	USDA - 1 1/2 years - Archaeologist; BLM - 3 years Archaeologist
Bill Gregg	Recreation, Visual Resources, Wilderness	BS Forestry	BLM - 3 years Outdoor Recreation Planner
Victor Grizzle	Land Uses, Transportation	BS Wildlife Science	BLM - 3 years Realty Specialist, 1 year Range
Kent Hamilton	Social and Economic Factors	BS Agricultural Economics	BLM - 4 yrs., BIA - 16 yrs. Economist and Land Use Planner
Pauline McCauley	American Indian Concerns	Vocational School Admin/Steno	BIA - 14 years; BLM 2 years; Range Tech.
Mike O'Neill	Paleontology	BA Biological Anthropology	BLM - 4 years Paleontologist
Ralph Pericoli	Livestock Grazing, Vegetation, T&E	BS Wildlife Management	BLM - 5 years Range Conservationist
Dave Renwald	Wildlife/T&E	BS Wildlife Science MS Range Science	BLM - 6 years, Wildlife Biologist; State of Iowa - 1 year Wildlife Biologist

TABLE 4-2 (concluded)

Jack Spears	Soils, Surface Reclamation	BS Range and Wildlife Science	BLM - 2 1/2 years Range Conservationist; 2 years Surface Reclamation Specialist BLM
Sarah Spurrier	Editor	BA Psychology	BLM - 5 years Writer/Editor
Carol Thompson	American Indian Concerns	BA Anthropology	BLM - 2 years Archaeologist; BIA 11 years Teacher/Anthropology

Support Personnel

Name	Experience (BLM)	Name	Experience (BLM)
Lulu Burger	4 years Secretary	Jeffery S. Nighbert	4 yrs. District Cartographer
Monica Chavez	8 years Clerk-Typist	Esther Willetto	1 year Range Clerk
Myrna Finke	2 yrs. Cartographic Aid	Dave Wunker	2 months Cartographic Aid
Penelope A. Mahon	2 1/2 yrs. Clerk Typist, Supervisory Editorial Assistant		

APPENDICES

APPENDIX A
BACKGROUND INFORMATION

APPENDIX A-1
TRACT SUMMARIES

LA PLATA #1 TRACT
FEDERAL OWNERSHIP - SURFACE MINE

The La Plata #1 Tract, approximately 200 acres in size, is located 15 miles north of Farmington, New Mexico. Land surface and coal within the tract are federally owned. The tract total and unleased coal is an estimated 8.8 million tons of mineable reserves and 7.5 million tons of recoverable reserves. The expected production rate would be 1.5 million tons per year for a projected mine life of 7 years. Total expected revenue from federal coal within the tract is $150 million with an expected federal royalty value of $18.8 million for the life of the mine. Approximately 40 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 200 acres.

Approximately 112 employees would be needed to mine the reserves. The mining activities would require approximately 30 acre feet/year of water from deep wells for mining operations.

Surface disturbance on the acreage of each tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation. The hydrological resource impacts include destruction of stratified nature of Fruitland formation overburden and all confining layers above the Pictured Cliffs Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage from the underlying Pictured Cliffs Sandstone which contains water of a much greater salinity. There is also a possibility of changes in water quality in wells and lowering of water levels in wells tapping the same aquifers in vicinity of the tract.

Paleontological resources show no significant impacts. Total acreage disturbed on the paleontological resources would be 250 acres.

The impacts to the range resources would be the loss of 19 AUM's/year and the destruction of one stock reservoir.

LA PLATA #2 TRACT
FEDERAL OWNERSHIP - UNDERGROUND MINE

The La Plata #2 Tract, approximately 200 acres in size, is located 15 miles north of Farmington, New Mexico. Land surface and coal within the tract are federally owned. The tract total and unleased coal is an estimated 12.0 million tons of mineable reserves and 2.0 million tons of recoverable

reserves. The expected production rate would be .50 million tons per year for a projected mine life of 7 years. Total expected revenue from federal coal within the tract is $52.5 million with an expected federal royalty value of $4.2 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 125 employees would be needed to mine the reserves. The mining activities would require approximately 40 acre feet/year from deep wells for mining operations.

Impacts from ground water include seepage of water from the underlying Pictured Cliffs Sandstone into the mine which might effect yield and water levels in wells. Subsidence might disrupt overlying bedrock aquifers in the Fruitland formation by fracturing them and affect potential ground water supplies from that aquifer.

The range resource impacts would include the loss of 8 AUM's/year of forage on the surface facilities.

The impacts to cultural resources would be one Anasazi site and a portion of another, LA 5605. The LA 5605 site consists of a 500 foot by 3,500 foot habitation site and is also located in La Plata Tract #4. These sites may be destroyed by surface activities associated with the underground mining.

STAR LAKE WEST #2 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Star Lake West #2 Tract, approximately 760 acres in size, is located 30 miles west of Cuba, New Mexico. Of the total 760 acres for land surface 440 acres are unleased Federal and 320 acres are State. The acreage for the coal reserves is 760 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 28.0 million tons with the tract total of 28.0 million tons. The recoverable reserves tonnage of unleased Federal is 24.0 million tons with the tract total of 24.0 million tons. The expected production rate would be 2.0 million tons per year for a projected mine life of 14 years. Total expected revenue from federal coal within the tract is $470 million with an expected federal royalty value of $58.8 million for the life of the mine. Approximately 65 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 760 acres.

Approximately 150 employees would be needed to mine the reserves. The mining activities would require approximately 65 acre feet/year of water from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and

reclamation. The hydrological resource impacts include destruction of stratified nature of Fruitland formation overburden and all confining layers above the Pictured Cliffs Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage of water from the underlying Pictured Cliffs Sandstone which may contain water of a much greater salinity than the water in the fruitland formation. Possible offsite reduction of well yields, lowering of water levels, and changes in water quality in wells. Withdrawal of ground water from deep aquifers for reclamation and dust suppression would alter ground water flow near the wells and may cause a lowering of water levels in wells tapping the same aquifers in vicinity of the tract.

Surface Water impacts include the following:

a. Runoff from mined area would be impounded, resulting in an unknown but probably small amount of surface water lost to evaporation.

b. Increase in dissolved and suspended solids concentrations in runoff during reclamation phase until channels stabilize. This area requires special attention during the mining and reclamation phases because a major tributory to Chaco Wash, Arroyo Pueblo Alto, drains the area.

c. Use of saline or sodic ground water from "deep" aquifers may impact water quality of runoff from reclaimed areas.

d. 16 acres of floodplain on Arroyo Pueblo Alto in T. 20 N., R. 6 W., Section 18 would be disrupted.

The loss of approximately 58 AUM's/year of native forage would occur.

The visual resources in this tract are in Class III management area and surface mining would not meet the management objectives for this classification.

Paleontological resource impacts for this tract reveal no fossil localities recorded. However, potential for subsurface fossils contained in the overburden is high. Although high probability exists for the destruction of any megafossils and associative data, the microfossil, invertebrate and botanical material could still retain a certain degree of scientific and educational utility. The estimated fossil localities disturbed in the first year would be 10. The total acres disturbed is 860. While the estimated total number of fossil localities disturbed is 51.

Cultural resource impacts indicate that two isolated localities have been recorded. Sites in the tract would be destroyed by mining activities.

As for any recreation impacts, surface mining activities on Star Lake West #2 could disrupt the Continental Divide National Scenic Trail location.

KIMBETO #1 TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The Kimbeto #1 Tract, approximately 3,680 acres in size, is located 1 to 3 miles south of the settlement of Kimbeto and/or 45 miles southeast of Farmington, New Mexico. Of the total 3,680 acres for land surface 2,240 acres are unleased Federal, and 1,440 acres are private. The acreages for the coal reserves are 3,360 acres unleased Federal and 320 acres for private.

The tract contains mineable reserves of unleased Federal at 145 million tons with the tract total of 158 million tons. The recoverable reserves tonnage of unleased Federal is 38 million tons with the tract total of 41 million tons. The expected production rate would be 1.2 million tons per year for a projected mine life of 37 years. Total expected revenue from federal coal within the tract is $948 million with an expected federal royalty value of $75.8 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 275 employees would be needed to mine the reserves. The mining activities would require approximately 23 million gallons of water per year from deep wells for mining operations.

Impacts on ground water from deep aquifer(s) for dust suppression and reclamation would alter ground-water flow near the well(s) and may cause a lowering of water levels in wells tapping the same aquifer(s) in the vicinity of tract. Subsidence may disrupt overlying bedrock aquifer(s) in the Fruitland formation by fracturing them. This may affect well yields, water levels and possible water quality in wells tapping those aquifers. Two wells exist within this tract. The quantity or quality of water available to these wells may be affected by subsidence and/or mine dewatering.

Paleontological resource impacts show three recorded sites within the boundaries of the tract. Underground mining activities will not impact these or any related sites within the tract. Above ground activities or facilities will impact these or any potential sites. The destruction of these surface resources could result in the loss of some data with minimal potential for significance. The total acreage which would be disturbed is 80 acres.

Impacts to the range resources would involve the loss of 5 AUM's/year for forage from the surface facilities of the underground mine.

As for impacts associated with visual resources this tract is entirely in a Class III management area. Surface facilities involved with an underground mine would not meet the management objectives for this classification.

The impacts for cultural resources involve five sites and seven isolated occurrences which have been recorded within the tract. The known sites and isolated in this tract may be impacted by the above ground activities associated with the subsurface mining.

The American Indian impacts include 8 known Navajo homesites:

a. Two homes on T. 22 N., R. 10 W., Section 2: NW1/4, on Indian allotment.

b. Two homes on T. 22 N., R. 10 W., Section 2: SW1/4, on Indian allotment. Allottees and her children live on this allotment and have not made a response to our consultation letter.

c. Two homes on T. 22 N., R. 10 W., Section 11: NW1/4, on Indian allotment. Allotment owner lives on this and has responded to our consultation where she wants to go on record as having a firm intent not to consent to leasing of coal under her land.

d. Two homes on T. 22 N., R. 10 W., Section 10: NW1/4, on Indian allotment. Owner made known she does not want coal development on her land. She lives on it and uses it for grazing.

The sacred burial sites, herb gathering areas, and offerings have not been specifically identified. Although the Navajo medicine men have stated underground mining is still just like surface mining whereas it is destroying or scarring Mother Earth.

KIMBETO #2 TRACT
FEDERAL OWNERSHIP - SURFACE MINE

The Kimbeto #2 Tract, approximately 640 acres in size, is located 46 miles southeast of Farmington, New Mexico. Land surface and coal within the tract are federally owned. The tract total and unleased coal is an estimated 20 million tons of mineable reserves and 18 million tons of recoverable reserves. The expected production rate would be 1 million tons per year for a projected mine life of 20 years. Total expected revenue from federal coal within the tract is $366 million with an expected federal royalty value of $45.8 million for the life of the mine. Approximately 35 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 640 acres.

Approximately 75 employees would be needed to mine the reserves. The mining activities would require approximately 20 acre feet/year of water from deep wells for mining operations.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

Ground water impacts involve destruction of stratified nature of Fruitland formation overburden and all confining layers above the Pictured Cliffs Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage of water from the underlying Pictures Cliffs

Sandstone which contains water of a greater salinity than the water in the Fruitland formation at some locations.

Possible offsite reduction of well yields, lowering of water levels, and changes in water quality in wells tapping the Fruitland formation and Pictured Cliffs Sandstone.

Withdrawal of 20 acre feet per year of ground water from "deep" aquifer(s) for reclamation and dust suppression would alter ground-water flow near the well(s) and may cause a lowering of water levels in wells trapping the same aquifer in vicinity of the tract.

As for surface water impacts the following would occur:

a. Runoff from mined area would be impounded, resulting in an unknown but probably small amount of surface water lost to evaporation.

b. Increase in dissolved and suspended solids concentrations in runoff during reclamation phase until channels stablize.

c. Use of saline or sodic ground water from "deep" aquifers may impact water quality of runoff from reclaimed area.

d. 180 acres of floodplain on Betonnie Tsosie Wash drainage would be disrupted.

The paleontological impacts show a potential estimate that there are significant fossils contained within the overburden comprising Kimbeto Tract #2. This is indicated by the high number of significant fossil sites located in the stratigraphically related Ah-shi-sle-pah Wash. It is estimated that some or possible all these sites would be destroyed if the proposed action is implemented.

The estimated fossil localities disturbed in the first year is 5. The total acreage disturbed would be 690 acres. While the estimated total number of fossil localities disturbed is 41.

The range resource impacts would include the loss of 138 AUM's/year of native forage from surface mining until revegetation occurs.

The visual resources in this tract are in Class III management area. Surface mining of approximately 35 acres per year would not meet the management objectives for this classification.

The impacts for cultural resources involve three sites which have been located within the tract. The largest is a 98 acre quarry/lithic scatter. The known sites and others in the tract during future inventory would be destroyed by mining activities.

NAGEEZI TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The Nageezi Tract, approximately 13,760 acres in size, is located 34 miles southeast of Farmington, New Mexico. Of the total 13,760 acres for land surface 11,680 acres are unleased Federal, 160 acres are State and 1,920 acres are private. The acreages for the coal reserves are 13,600 acres unleased Federal and 160 acres for State.

The tract contains mineable reserves of unleased Federal at 466 million tons with the tract total of 587 million tons. The recoverable reserves tonnage of unleased Federal is 83 million tons with the tract total of 109 million tons. The expected production rate would be 2.1 million tons per year for a projected mine life of 67 years. Total expected revenue from federal coal within the tract is $2.71 billion with an expected federal royalty value of $217 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 400 employees would be needed to mine the reserves. The mining activities would require approximately 35 million gallons per year of water from deep wells for mining operations.

The following impacts may occur to ground water:

1. Subsidence may disrupt overlying bedrock aquifer(s) in the Ojo Alamo Sandstone and Nacimiento Formation for fracturing them. This would affect well yields, water levels and possibly water quality in wells tapping those aquifers.

2. Subsidence may disrupt alluvial aquifer and affect well yields, water levels, and possibly quality in wells tapping those aquifers.

3. Approximately 100 acre-feet per year of ground water from "deep" aquifers(s) for dust suppression and reclamation would alter ground-water flow near the well(s) and could cause a lowering of water levels in wells tapping the same aquifer(s) in the vicinity of tract.

4. Two BLM wells exist within the tract. Both are completed in aquifers overlying the coal beds. The quantity or quality of water available to these wells may be affected by subsidence and/or mine dewatering. Some wells outside the tract could also be affected.

A maximum of 80 acres of native vegetation would be destroyed for surface facilities for the underground mine. The range impacts result in a loss of 4 AUM's/year.

The visual resource impacts show the majority of this tract is within a Class III management area while a portion is in a VRM Class IV area. Surface facilities associated with an underground mine would not meet the management objectives for either of these classifications.

The impacts for cultural resources show a portion of the 61 recorded sites and 105 recorded localities, isolated artifacts and current cultural

manifestations in the tract outside of the Pierre's Site and defined in PL 96-550, and other resources recorded during future cultural inventories may be impacted by the above ground activities associated with the subsurface mining.

The Pierre's Ruin Community (Pierre's Site) included in PL 96-550 has been withdrawn from surface disturbance. All of Section 12 and the W1/2 of Section 7 has been nominated to the National Register of Historic places as the Pierre's Archaeological District. Subsidence of the surface due to subsurface mining may occur during or after mining operations.

The American Indian impacts include 6 known Navajo homesites:

a. A large house located on T. 23 N., R. 10 W., Section 8: SE1/4SW1/4.

b. A house on T. 24 N., R. 10 W., Section 34: SW1/4SW1/4 on Indian allotment.

c. Two houses in T. 24 N., R. 10 W., Section 28: NW1/4NE1/4 on Indian allotment.

d. One house with corrals located in T. 24 N., R. 10 W., Section 29: SW1/4NW1/4 on Indian allotment.

e. A new house near the NE1/4 corner of Section 30, T. 24 N., R. 10 W.

These areas are under grazing lease to the Navajo Tribe, under Section 15 of the Taylor Grazing Act.

The sacred burial sites, herb gathering areas, and offerings have not been specifically identified, but the Navajo Medicine men have stated underground mining is still just like surface mining whereas it is destroying or scarring Mother Earth.

GALLO WASH #1 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Gallo Wash #1 Tract, approximately 320 acres in size, is located 38 miles west of Cuba, New Mexico. Of the total 320 acres for land surface 120 acres are unleased Federal and 200 acres are withdrawn under Public Land Order 2198 for Indian Use. The acreages for the coal reserves are 320 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 11.0 million tons with the tract total of 11.0 million tons. The recoverable reserves tonnage of unleased Federal is 10.0 million tons with the tract total of 10.0 million tons. The expected production rate would be 2.0 million tons per year for a projected mine life of 7 years. Total expected revenue from federal coal within the tract is $190 million with an expected federal royalty value of $23.8 million for the life of the mine. Approximately 67 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 320 acres.

Approximately 150 employees would be needed to mine the reserves. The mining activities would require approximately 100 acre feet/year of water from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

Ground water impacts include the following.

a. Destruction of stratified nature of Fruitland formation overburden and all confining layers above the Pictured Cliffs Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage from the underlying Pictured Cliffs Sandstone which contains water of a much greater salinity than the water in the Fruitland formation at some locations.

b. Possible withdrawal of 100 acre feet per year of ground water from "deep" aquifer(s) for reclamation and dust suppression would alter ground water flow near the well(s) and may cause a lowering of water levels in wells tapping the same aquifer in the vicinity of the tract.

Paleontological resource impacts show that there are approximately 9 recorded fossil sites located within or immediately adjacent to the Gallo Wash #1 (Bypass) tract. It is estimated that there are, potentially, at least 20 more fossil sites not recorded. Some or all of these sites would be destroyed during mining operations. The disruption and rearrangement of fossils from their original position in the strata will destroy associations of fossils and hinder taphonomic and paleontological studies. Removal or disturbance of fossils will likewise preclude biostratigraphic studies based on successions of species or assemblages.

The estimated fossil localities disturbed in the first year would be 10. The total acreage disturbed will be 420 acres. While the estimated total number of fossil localities disturbed would be 41.

Impacts to the range resources would involve the loss of 38 AUM's/year of forage until reclamation is effective.

The visual resources in this tract are in Class III management area while a portion is in a VRM Class IV area. Surface mining would not meet the management objectives for either of these classifications.

The American Indian impacts show burial sites, herb gathering areas, sacred or offering points have not been identified. If any are identified, they would be impacted by surface mining which would violate the American Indian Religious Freedom Act PL-341.

As for any recreational impacts surface mining activities on Gallo Wash #1 could disrupt the Continental Divide National Scenic Trail location.

GALLO WASH #2 TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The Gallo Wash #2 Tract, approximately 1,680 acres in size, is located 40 miles west of Cuba, New Mexico. Of the total 1,680 acres for land surface 600 acres are unleased Federal, 880 acres are State and 200 acres are private. The acreages for the coal reserves are 760 acres unleased Federal, 720 acres for State and 200 acres for private.

The tract contains mineable reserves of unleased Federal at 35 million tons with the tract total of 75 million tons. The recoverable reserves tonnage of unleased Federal is 9 million tons with the tract total of 19 million tons. The expected production rate would be 2.1 million tons per year for a projected mine life of 12 years. Total expected revenue from federal coal within the tract is $215 million with an expected federal royalty value of $17.2 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 250 employees would be needed to mine the reserves. The mining activities would require approximately 23 million gallons of water per year from deep wells for mining operations.

Ground water impacts include the following:

a. Subsidence might disrupt overlying bedrock aquifers in the Ojo Alamo Sandstone by fracturing, and affect potential local ground water supplies from this aquifer.

b. Subsidence might disrupt alluvial aquifer and affect potential local supplies of shallow ground water.

c. Seepage of water from the underlying Pictured Cliffs Sandstone into the mine might affect the yield and water level of one well completed in this aquifer about one mile west of the tract.

Paleontological resource impacts show that there is one recorded fossil site in Gallo Wash #2 tract located in T. 21 N., R. 8 W., Section 2: SW1/4SW1/4. However there will be no significant impact. There would be a total of 80 acres disturbed in this tract.

Impacts to the range resources would involve the loss of 7 AUM's/year of forage from the surface facilities of the underground mine. Two reservoirs and one cattleguard may be destroyed by location of surface facilities.

The cultural resources impacts indicated two isolated artifacts and no sites recorded in the portions of the tract containing Federal coal or surface. Sites may be destroyed by surface activities associated with

subsurface mining. The American Indian impacts include 6 known Navajo dwellings: three homes on the NW1/4, Section 11, T. 21 N., R. 8 W., on public land which is being considered in the Navajo Land Exchange. Three homes on the NE1/4, Section 10, T. 21 N., R. 8 W., on public land which is being considered in the Navajo Land Exchange. Three of these homes may be on the dividing line between tracts 2 and 3.

BISTI #6/8 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Bisti #6/8 Tract, approximately 360 acres in size, is located 31 miles south of Farmington, New Mexico. The total 360 acres of land surface are private. The acreages for the coal reserves are 360 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 1.0 million tons with the tract total of 1.0 million tons. The recoverable reserves tonnage of unleased Federal is 1.0 million tons with the tract total of 1.0 million tons. The expected production rate would be 5.1 million tons per year for a projected mine life of 4 years. Total expected revenue from federal coal within the tract is $18.2 million with an expected federal royalty value of $1.49 million for the life of the mine. Approximately 40 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 120 acres.

Approximately 20 employees would be needed to mine the reserves. The mining activities would require approximately 25 acre feet/year of water from deep wells for reclamation and dust control.

Air quality impacts show the estimated maximum off-site total suspended particulate (TSP) would be 25 micro grams per cubic meter (ug/m^3). Background air quality in the area is estimated at (30 ug/m^3). This would give a total of 55 ug/m^3 compared to the annual New Mexico standard of 60 ug/m^3. The air quality could exceed the annual New Mexico standard if operational procedures are not instituted.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden, removal, stockpiling, and reclamation.

Ground water impacts include the following:

a. Destruction of stratified nature of Fruitland formation overburden and all confining layers above the Pictured Cliffs Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage from the underlying Pictured Cliffs Sandstone which contains water of a much greater salinity than the water in the Fruitland formation at some locations.

b. Local destruction of potential shallow sources of ground water as mining proceeds through alluvial channels.

c. Less runoff locally to alluvial channels downstream during mining and after reclamation, with possibly less recharge to ground water in the alluvium.

The paleontological resource impacts show an estimated 5 fossil localities disturbed in the first year. The total of 170 acres would be disturbed. While the estimated total number of fossil localities disturbed would be 33. There are thirteen recorded fossil sites within Bisti Tract #8 in T. 23 N., R. 13 W., Section 6: NW1/4, NE1/4 and SE1/4SE1/4. None of these sites are considered significant, however, potential importance remains high due to the stratigraph relationship of this area with the Bisti Badlands area. Implementation of the Proposed Action could lead to the destruction of some or all of the fossil-collecting sites in this area.

Impacts to the range resources would involve the loss of 20 AUM's/year of forage. While drainage to one reservoir south of the tract in Section 15 would be destroyed.

The visual resource impacts in this tract are in Class III and IV management area. Surface mining would not meet the management objectives for this classification and would destroy topography and scenic features to fragile badlands and the visual quality to the adjacent Bisti/De-na-zin ACEC (proposed).

The impacts for cultural resources involve two Navajo graves from an unknown date and two cultural resources sites occur in the tract. Sites in the tract would be destroyed by mining activities.

The American Indian impacts include 2 known Navajo dwellings:

One home on NE1/4, Section 15, T. 23 N., R. 13 W., on Indian allotted land.

One home on NW1/4, Section 17, T. 23 N., R. 13 W., on Indian allotted land.

These homes would be destroyed if mining occurs.

These areas are under grazing lease to the Navajo Tribe under Section 15 of the Taylor Grazing Act. Each permittee is paying by the acre to graze these lands.

There are also two sacred burial sites on the NW1/4 corner of Section 15, T. 23 N., R 13 W., and there may be others.

The recreation impacts on this tract shows that surface facilities and mining could destroy topographic and scenic features. This area has been recognized as having high quality scenic resources and has been particularly noted for its geologic sightseeing values.

The wilderness impacts shows that sights and sounds associated with the adjacent surface mining of Bisti 6/8 could disrupt the naturalness and opportunities for solitude in the Bisti WSA.

LEE RANCH EAST TRACT
MIXED OWNERSHIP - SURFACE MINE

The Lee Ranch East Tract, approximately 2,184 acres in size, is located 30 miles northeast of Grants, New Mexico. The total 2,184 acres land surface are private. The acreages for the coal reserves are 1,883 acres unleased Federal, and 301 acres for private.

The tract contains mineable reserves of unleased Federal at 16.0 million tons with the tract total of 38.0 million tons. The recoverable reserves tonnage of unleased Federal is 14.0 million tons with the tract total of 33.0 million tons. The expected production rate would be 800,000 million tons per year for a projected mine life of 42 years. Total expected revenue from federal coal within the tract is $272 million with an expected federal royalty value of $34 million for the life of the mine. Approximately 24 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 969 acres.

Approximately 60 employees would be needed to mine the reserves. The mining activities would require approximately 45 acre feet/year of water from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

Ground water impacts include the following:

a. Destruction of stratified nature of Menefee formation (Cleary Coal Member) and all confining layers above the Point Lookout Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage of water from the underlying Point Lookout Sandstone, which may contain water of a much greater salinity than the water in the Menefee formation at some locations.

b. The coal deposits of this area are also the major aquifers tapped by wells in the area. Offsite reduction of spring and well yields, lowering of water levels, and changes in water quality in wells tapping the Menefee formation and Point Lookout Sandstone would result.

c. One flowing well and two springs exist within the tract. If these are located in areas to be mined they would be destroyed.

The paleontological resource shows no survey data for this tract. However, 1,019 total acres would be disturbed.

Impacts to the range resources would involve the loss of 255 AUM's/year of native forage.

As for any recreational impacts, surface mining activities on Lee Ranch East could disrupt the Continental Divide National Scenic Trail location.

No cultural resources are known to have been recorded. However, fourteen sections have been inventoried for cultural resources within or adjacent to the Lee Ranch tracts. If similar site densities occur in the parcels of this tract it is predicted there may be between 10 and 35 sites.

LEE RANCH MIDDLE TRACT
MIXED OWNERSHIP - SURFACE MINE

The Lee Ranch Middle Tract, approximately 14,546 acres in size, is located 25 miles Northwest of Grants, New Mexico. Of the total 14,546 acres for land surface 1,120 acres are State and 13,426 acres are private. The acreages for the coal reserves are 4,786 acres unleased Federal, 1,120 acres for State and 8,640 acres for private.

The tract contains mineable reserves of unleased Federal at 86.0 million tons with the tract total of 240.0 million tons. The recoverable reserves tonnage of unleased Federal is 73.0 million tons with the tract total of 204.0 million tons. The expected production rate would be 5.1 million tons per year for a projected mine life of 42 years. Total expected revenue from federal coal within the tract is $1,469 million with an expected federal royalty value of $182.5 million for the life of the mine. Approximately 148 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 5,904 acres.

Approximately 382 employees would be needed to mine the reserves. The mining activities would require approximately 1,000 acre feet/year of water from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

The air quality impacts show the estimated maximum off-site total suspended particulates (TSP) would be 29 micrograms per cubic meter (ug/m^3). Background air quality in the area is estimated at (30 ug/m^3). This would give a total of 59 ug/m^3 compared to the annual New Mexico standard of 60 ug/m^3. The air quality could exceed the annual New Mexico standard if operational procedures are not instituted.

Ground water impacts include the following:

a. Destruction of stratified nature of Menefee formation (Cleary Coal Member) and all confining layers above the Point Lookout Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage of water from the underlying Point Lookout Sandstone, which may contain water of a much greater salinity than the water in the Menefee formation at some location.

b. The coal deposits of this area are also the major aquifers tapped by wells in the area. Offsite reduction of well yields, lowering of water levels, and changes in water quality in wells tapping the Menefee formation and Point Lookout Sandstone would result.

c. Offsite reduction of spring yields and water quality would occur.

d. 5 wells (4 flow) and approximately 10 springs exist within the tract. If these are located in areas to be mined they would be destroyed.

The paleontological resource impacts show that there are two recorded fossil sites known in the study area. One of these sites is considered to be significant. It is located in the NW1/4SE1/4NE1/4 of Section 35: T. 15 N., R. 8 W. This site contains a diverse and well preserved assemblage of plant fossils of the Menefee formation. There is approximately 6,104 total acres that would be disturbed.

Impacts to the range resources would involve the loss of 1,606 AUM's/year of native forage.

The cultural resource impacts indicate six sites that have been recorded within the tract parcels containing Federal coal. Fourteen sections have been inventoried for cultural resources within or adjacent to the Lee Ranch tracts. If similar densities occur in the parcels containing Federal coal of this tract it is predicted there may be between 32 and 43 sites.

As for any recreational impacts, surface mining activities on Lee Ranch Middle could disrupt the Continental Divide National Scenic Trail location.

LEE RANCH WEST TRACT
MIXED OWNERSHIP - SURFACE MINE

The Lee Ranch West Tract, approximately 16,640 acres in size, is located 30 miles Northwest of Grants, New Mexico. Of the total 16,640 acres for land surface 160 acres are unleased Federal, 1,760 acres are State and 14,720 acres are private. The acreages for the coal reserves are 6,800 acres unleased Federal, 1,760 acres for State and 8,080 acres for private.

The tract contains mineable reserves of unleased Federal at 101.0 million tons with the tract total of 238.0 million tons. The recoverable

reserves tonnage of unleased Federal is 86.0 million tons with the tract total of 202.0 million tons. The expected production rate would be 3.0 million tons per year for a projected mine life of 25 years. Total expected revenue from federal coal within the tract is $1,717 million with an expected federal royalty value of $214.625 million for the life of the mine. Approximately 188 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 7,539 acres.

Approximately 375 employees would be needed to mine the reserves. The mining activities would require approximately 1,000 acre feet/year of water from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

The air quality impacts show the estimated maximum off-site total suspended particulates (TSP) would be 29 micrograms per cubic meter (ug/m^3). Background air quality in the area is estimated at (30 ug/m^3). This would give a total of 59 ug/m^3 compared to the annual New Mexico standard of 60 ug/m^3. The air quality could exceed the annual New Mexico standard if operational procedures are not instituted.

The ground water impacts include the following:

a. Destruction of stratified nature of Menefee formation (Cleary Coal Member) and all confining layers above the Point Lookout Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage of water from the underlying Point Lookout Sandstone, which may contain water of a much greater salinity than the water in the Menefee formation at some locations.

b. The coal deposits of this area are also the major aquifers tapped by wells in the area. Offsite reduction of well yields, lowering of water levels, and changes in water quality in wells tapping the Menefee formation and Point Lookout Sandstone would result.

c. Offsite reduction of spring yields and water quality would occur.

d. Three wells exist within the tract; one of these is a flowing well. If these are located in areas to be mined they would be destroyed.

The paleontological resource impacts show that there are two recorded fossil sites known in the study area. One of these sites is considered to be significant. It is located in the NW1/4SE1/4NE1/4 of Section 35: T. 15 N., R. 8 W. This site contains a diverse and well preserved assemblage of plant fossils of the Menefee formation. There are approximately 7,739 total acres that would be disturbed.

Impacts to the range resources would involve the loss of 1935 AUM's/year of native forage.

The cultural resource impacts indicate twenty seven sites have been recorded within the tract parcels containing Federal coal. Also recorded are several segements of the Chacoan Roadway system. Fourteen sections have been inventoried for cultural resources within or adjacent to the Lee Ranch tracts. If similar site densities occur in the parcels containing Federal coal of this tract it is predicted there may be between 70 and 100 sites.

As for any recreational impacts, surface mining on Lee Ranch West could disrupt the Continental Divide National Scenic Trail location.

DIVIDE TRACT
MIXED OWNERSHIP - SURFACE MINE

The Divide Tract, approximately 6,960 acres in size, is located 30 miles North of Grants, New Mexico. Of the total 6,960 acres for land surface, 400 acres are unleased Federal, 640 acres are State and 5,920 acres are private. The acreages for the coal reserves are 3,120 acres unleased Federal, 640 acres for State and 3,200 acres for private.

The tract contains mineable reserves of unleased Federal at 16.0 million tons with the tract total of 43.0 million tons. The recoverable reserves tonnage of unleased Federal is 14.0 million tons with the tract total of 37.0 million tons. The expected production rate would be .9 million tons per year for a projected mine life of 42 years. Total expected revenue from federal coal within the tract is $272 million with an expected federal royalty value of $34 million for the life of the mine. Approximately 75 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 3,000 acres.

Approximately 75 employees would be needed to mine the reserves. The mining activities would require approximately 50 acre feet/year of water from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

The ground water impacts include the following:

a. Destruction of stratified nature of Gibson Coal Member of the Crevasse Canyon formation overburden and all confining layers above the Dalton Sandstone Member of the Crevasse Canyon formation. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage of water from the underlying Dalton Sandstone Member which may contain water of a much greater salinity than the water in the Gibson Coal Member at some locations.

b. Possible offsite reduction of well yields, lowering of water levels, and changes in water quality in wells tapping the Dalton Sandstone Member.

c. One well exists within the tract. This well is owned by the Navajo Tribe. If it is located in an area to be mined it would be destroyed. If not located in an area to be mined, the yield and water level would likely be affected by wells drilled into the Gallup Sandstone for reclamation water.

The paleontological resource impacts show that there several recorded fossil sites on the tract, five of which are are considered significant. These are located in T. 16 N., R. 10 W., Section 36: NE1/4SE1/4; Section 25: SE1/4SW1/4; Section 23: NW1/4SE1/4, and SW1/4NE1/4; Section 2: NE1/4SW1/4NE1/4; Section 1: NE1/4NE1/4SW1/4. There are approximately 3,100 total acres that would be destroyed.

Impacts to the range resources would involve the loss of 282 AUM's/year of native forage.

The cultural resource impacts indicate five sites have been recorded in portions of the tract containing Federal coal or surface. Cultural resource inventories have been conducted to the north, west, and east. If similar site densities ocurr across this tract it is predicted there may be between 48 and 105 sites.

Recreational impacts show that the Continental Divide passes close by this tract. Surface mining would have a serious aesthetic impact upon the Continental Divide National Scenic Trail if it is routed through this area.

The American Indian impacts include 3 known Navajo dwellings: three homes on the NW1/4, Section 4, T. 15 N., R. 10 W., on Indian allotted land.

HOSPAH #1 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Hospah #1 Tract, approximately 17,960 acres in size, is located 30 miles north of Grants, New Mexico. Of the total 17,960 acres for land surface 2,080 acres are State and 15,880 acres are private. The acreages for the coal reserves are 1,600 acres unleased Federal, 1,920 acres for State and 14,440 acres for private.

The tract contains mineable reserves of unleased Federal at 22.0 million tons with the tract total of 218 million tons. The recoverable reserves tonnage of unleased Federal is 19.0 million tons with the tract total of 186 million tons. The expected production rate would be 10.3 million tons per year for a projected mine life of 20 years. Total expected revenue from federal coal within the tract is $374 million with an expected federal royalty value of $46.8 million for the life of the mine. Approximately 80 surface acres would be disturbed annually for unleased Federal coal. Surface disturbance over the life of the mine would total 1,440 acr

Approximately 75 employees would be needed to mine the reserves. The mining activities would require approximately 60 acre feet/year of water from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

The ground water impacts include the following:

a. Destruction of stratified nature of Cleary Coal Member of Menefee formation overburden and all confining layers above the Point Lookout Sandstone. These would be replaced with crumbled shale and sandstone rubble having greater porosity than the original stratified material. This could result in upward leakage of water from the underlying Point Lookout Sandstone, which may contain water of a greater salinity than the water in the Menefee formation in this vicinity.

b. Possible offsite reduction of well yields, lowering of water levels, and changes in water quality in wells tapping the Menefee formation and Point Lookout Sandstone.

c. Four known wells exist within the tract. Three of these are completed in the Point Lookout Sandstone and/or Menefee formation. The other well taps deeper aquifers. Any wells located in areas to be mined would be destroyed, regardless of the aquifer tapped.

The paleontological resource impacts indicate through reconnaisance reports the presence of potentially fossiliferous outcrops throughout the Hospah Tract. However, no significant impacts have been found. The total acres disturbed in the area would be 80.

Impacts to the range resources would involve the loss of 173 AUM's/year of native forage.

The cultural resource impacts indicate four sites have been recorded in the portions of the tract with Federal minerals. A portion of a Chacoan Roadway crosses the tract. The South Hospah mine survey found an average site density of 13 sites per section. If a similar site density occurs in the portions of the tract with Federal minerals it is predicted there may be approximately 33 sites.

Recreational impacts show that the Continenal Divide passes through this tract. Mining and associated surface facilities could have an aesthetic impact upon the Continental Divide National Scenic Trail if it is routed through here.

HOSPAH #2 TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The Hospah #2 Tract, approximately 3,160 acres in size, is located 30 miles north of Grants, New Mexico. Of the total 3,160 acres for land surface 640 acres are State and 2,520 acres are private. The acreages for the coal reserves are 640 acres unleased Federal, and 2,520 acres for private.

The tract contains mineable reserves of unleased Federal at 10 million tons with the tract total of 59 million tons. The recoverable reserves tonnage of unleased Federal is 5 million tons with the tract total of 30 million tons. The expected production rate would be 2.9 million tons per year for a projected mine life of 13 years. Total expected revenue from federal coal within the tract is $125 million with an expected federal royalty value of $1 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 125 employees would be needed to mine the reserves. The mining activities would require approximately 40 acre feet/year of water from deep wells for mining operations.

The ground water impacts include the following:

a. Subsidence might disrupt overlying bedrock aquifer(s) in the Menefee formation by fracturing them. This could affect well yields, water levels, and possibly water quality in wells tapping this aquifer in the vicinity of the tract.

Paleontological resources show that there is not expected to be any direct impact on potential fossil material from underground mining, however, there could be negative indirect impact from related activities and facilities on the surface. There would be a total of 80 acres disturbed in this tract.

Impacts to the range resources would involve the loss of 9 AUM's/year of forage on the surface facilities of the underground mine.

Recreational impacts show that the Continental Divide passes through this tract. Mining and associated surface facilities could have an aesthetic impact upon the Continental Divide National Scenic Trail if it is routed through here.

The cultural resource impacts show that one site has been recorded in the portion of the tract with Federal minerals. The South Hospah mine survey found an average site density of 13 sites per section. If a similar density occurs in the section of Federal minerals it is predicted there may be approximately 13 sites.

GAMERCO #1 (BYPASS) HC TRACT
MIXED OWNERSHIP - SURFACE MINE

The Gamerco #1 (Bypass) HC Tract, approximately 440 acres in size, is located 9 miles northwest of Gallup, New Mexico. The total 440 acres of land surface are private. The acreages for the coal reserves are 360 acres unleased Federal and 80 acres of private.

The tract contains mineable reserves of unleased Federal at 3.0 million tons with the tract total of 4.0 million tons. The recoverable reserves tonnage of unleased Federal is 3.0 million tons with the tract total

of 4.0 million tons. The expected production rate would be 140,000 tons per year for a projected mine life of 22 years. Total expected revenue from federal coal within the tract is $56 million with an expected federal royalty value of $7 million for the life of the mine. Approximately 8 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 150 acres.

Approximately 11 employees would be needed to mine the reserves. The mining activities would require approximately 30 acre feet/year of water from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

The ground water impacts include the following:

a. Destruction of stratified nature of Crevasse Canyon formation overburden and all confining layers above the Gallup Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in downward leakage of water from the overlying Crevasse Canyon formation which may contain water of a greater salinity than the water in the Gallup Sandstone at this location.

b. Possible offsite reduction of well yields, lowering of water levels, and changes in water quality in wells tapping the Menefee formation, Crevasse Canyon formation and Gallup Sandstone.

The paleontological resources show that there is potential for the presence of fossiliferous exposures containing important fossils. However, there is no survey data to date. The estimated total acreage disturbed would be 125.

Impacts to the range resources would involve the loss of 23 AUM's/year of native forage.

The American Indian impacts include 2 known Navajo dwellings: Two homes on SW1/4, Section 34: T. 16 N., R. 19 W., on Indian allotment.

BISTI #4 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Bisti #4 Tract, approximately 2,680 acres in size, is located 52 miles southeast of Farmington, New Mexico. Of the total 2,680 acres for land surface 1,040 acres are unleased Federal, 80 acres are State and 1,560 acres are private (PLO 1483 - 200 Acres). The acreages for the coal reserves are 2,600 acres unleased Federal, and 80 acres for State.

The tract contains mineable reserves of unleased Federal at 36 million tons with the tract total of 37.0 million tons. The recoverable reserves tonnage of unleased Federal is 30.0 million tons with the tract total of 31.0 million tons. The expected production rate would be 1.0 million tons per year for a projected mine life of 32 years. Total expected revenue from federal coal within the tract is $592 million with an expected federal royalty value of $74 million for the life of the mine. Approximately 60 surface acres would be disturbed annually for unleased Federal coal. Surface disturbance over the life of the mine would total 1,900 acres for unleased Federal Coal.

Approximately 75 employees would be needed to mine the reserves. The mining activities would require approximately 35 acre feet/year from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden, removal, stockpiling, and reclamation.

The ground water impacts include the following:

a. Destruction of stratified nature of Fruitland formation overburden and all confining layers above the Pictured Cliffs Sandstone. These would be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage from the underlying Pictured Cliffs Sandstone which contains water of a much greater salinity than the water in the Fruitland formation at some locations.

b. Possible offsite reduction of well yields, lowering of water levels, and changes in water quality in wells tapping the Cliff House Sandstone.

The paleontological resources show that there are 15 recorded fossil sites located within this tract. They are located in T. 23 N., R. 12 W., Section 26: S1/2S1/2, Section 35: N1/2N1/2. Most of these sites and the exposures in Section 34: NE1/4 contain potentially significant fossils. The estimated fossil localities disturbed in the first year would be 10. The total acreage figure will be 3,504. While the estimated total number of fossil localities disturbed would be 120.

Impacts to the range resources would involve the loss of 134 AUM's/year of native forage. While one reservoir and one reservoir drainage would be destroyed over the life of the mine.

The cultural resource impacts show that one locality has been recorded. However, no sites have been recorded in this tract.

Recreational impacts show that this tract is in an area referred to as the Fossil Forest which contains high quality opportunities for geological sightseeing. Many types of fossils can be found here as well as numerous <u>in situ</u> petrified tree stumps. Surface mining would destroy the sightseeing opportunities here.

The wildlife impacts indicate that there is an active (1981) ferruginous hawk nest (Unsuitability Criteria #14) in Bisti #4B, T. 23 N., R. 12 W., Section 35. However a buffer zone decided on by BLM and USFWS (5-24-81) takes in 25 acres of Section 35: NW1/4NW1/4 which is part of Bisti #4A.

Another active ferruginous hawk nest (Unsuitability Criteria #14) is located in T. 23 N., R. 12 W., Section 35: SW1/4NW1/4. A buffer zone agreed upon by BLM and USFWS (6-24-81) encompasses approximately 20 acres in Section 34: SE1/4NE1/4 and 70 acres in Section 35: NW1/4

The following American Indian sacred areas have been identified:

a. NW1/4NW1/4, Section 35, and N1/2N1/2, Section 34 have been designated as areas of herb gatherings in the MFP. The S1/2S1/2 of Section 26 should be included as herbs usually grow around higher areas.

b. The S1/2N1/2 of Section 34 and SW1/4NW1/4, E1/2NW1/4, NE1/4, Section 35 have been designated to be a herb gathering area in the MFP.

JOHNSON TRADING POST TRACT
MIXED OWNERSHIP - SURFACE MINE

The Johnson Trading Post Tract, approximately 3,440 acres in size, is located 15 miles southwest of Cuba, New Mexico. Of the total 3,440 acres for land surface 2,480 acres are unleased Federal and 960 acres are private. The acreages for the coal reserves are 2,720 acres unleased Federal 720 acres for private.

The tract contains mineable reserves of unleased Federal at 17.0 million tons with the tract total of 19.0 million tons. The recoverable reserves tonnage of unleased Federal is 14.0 million tons with the tract total of 16.0 million tons. The expected production rate would be 0.39 million tons per year for a projected mine life of 42 years. Total expected revenue from federal coal within the tract is $280 million with an expected federal royalty value of $35 million for the life of the mine. Approximately 86 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 3,440 acres.

Approximately 30 employees would be needed to mine the reserves. The mining activities would require approximately 60 acre feet/year from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden, removal, stockpiling, and reclamation.

The ground water impacts include the following:

a. Destruction of stratified nature of Fruitland formation overburden and all confining layers above the Pictured Cliffs Sandstone. Thesewould be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage from the underlying Pictured Cliffs Sandstone which contains water of a much greater salinity than the water in the Fruitland formation at some locations.

b. Four known wells exist within the tract. Any of these located in areas to be mined would be destroyed, regardless of the producing aquifer. Yields, water levels, and water quality of wells tapping the Quaternary alluvium and Pictured Cliffs Sandstone, but not in mined areas may be affected.

Paleontological material would be adversely impacted in Section 1, T. 20 N., R. 4 W., and the N1/2, NE1/4, Section 11. There are six documented fosssil sites within or immediately adjacent to the leasing boundary. The estimated fossil localities disturbed in the first year would be 11. The total acreage figure will be 3,504. While the estimated total number of fossil localities disturbed would be 317.

Impacts to the range resources would involve the loss of 328 AUM's/year of native forage. A drainage area of one reservoir would be cut off.

Major wildlife impacts include one active golden eagle nest which is located in the north part of the tract; T. 19 N., R. 4 W., Section 1. Unsuitability Criteria #11 would apply in this area. Destruction of the spring in T. 19 N., R. 4 W., Section 1 would displace long-eared owls roosting at the spring. The spring would also provide habitat for migratory non-game birds and this habitat would be lost with surface mining. Critical time for spring-time migrants would be April 15 through June 15 when heaviest concentrations of birds would occur.

Most of this tract is within a visual resource Class III management area while a portion is in a VRM Class IV area. Surface mining would not meet the managment objectives for either of these classifications.

The cultural resource impacts show that one site has been recorded in the portions of the tract containing Federal coal or surface.

The American Indian impacts include 8 known Navajo dwellings:

a. One home located on the NE1/4, Section 9, T. 19 N., R. 4 W., on public land, its on the outside edge or on the line of Navajo Land Exchange.

b. Seven homes located on the NW1/4, Section 7, T. 19 N., R. 3 W., on Indian allotted lands.

STAR LAKE EAST #1 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Star Lake East #1 Tract, approximately 2,000 acres in size, is located 22 miles southwest of Cuba, New Mexico. Of the total 2,000 acres for land surface 1,364 acres are unleased Federal, 80 acres are State and 556 acres are private. The acreages for the coal reserves are 1,840 acres unleased Federal, 80 acres for State and 80 acres for private.

The tract contains mineable reserves of unleased Federal at 61.0 million tons with the tract total of 67.0 million tons. The recoverable reserves tonnage of unleased Federal is 52.0 million tons with the tract total of 57.0 million tons. The expected production rate would be 2.0 million tons per year for a projected mine life of 32 years. Total expected revenue from federal coal within the tract is $1.03 billion with an expected federal royalty value of $128.8 million for the life of the mine. Approximately 70 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 2,040 acres.

Approximately 150 employees would be needed to mine the reserves. The mining activities would require approximately 100 acre feet/year of water from deep wells for reclamation and dust control.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden, removal, stockpiling, and reclamation.

The ground water impacts include the following:

a. Destruction of stratified nature of Fruitland formation overburden and all confining layers above the Pictured Cliffs Sandstone. Thesewould be replaced with crumbled shale and sandstone rubble having a greater porosity than the original stratified material. This may result in upward leakage from the underlying Pictured Cliffs Sandstone which contains water of a much greater salinity than the water in the Fruitland formation at some locations.
b. Possible offsite reduction of well yields, lowering of water levels, and changes in water quality in wells tapping the Quaternary alluvium, Fruitland formation, and Pictured Cliffs Sandstone.

The Paleontological resources show that there are six documented fossil sites within the boundaries of Star Lake East #1, all are considered low significance except locality BUNM-77-898. Due to the fossiliferous nature of Kirtland/Fruitland outcrops in this tract it is estimated that 60 potentially significant fossil sites would be destroyed during mining operations. The estimated fossil localities disturbed in the first year would be 10. The total acreage figure will be 2,140. While the estimated total number of fossil localities disturbed would be 248.

Impacts to the range resources would involve the loss of 214 AUM's/year of native forage.

Recreational impacts show that the Continental Divide passes through this tract. Mining and associated surface facilities could have an aesthetic impact upon the Continental Divide National Scenic Trail if it is routed through here.

This tract is in a visual resource Class III management area. Surface mining of approximately 70 acres per year would not meet the management objectives for this classification.

The cultural resource impacts show that three sites have been recorded in this tract. It is estimated that there may be between 17 and 35 additional sites.

The American Indian impacts include 11 known Navajo dwellings:

a. Six homes on the NW1/4NW1/4, Section 35 T. 20 N., R. 5 W., all on Indian allotted land. Land owners are not known and no consultation on this newly added portion.

b. Two homes on the NW1/4, Section 34, T. 20 N., R. 5 W., on public land proposed for Navajo Land Exchange.

c. One home on SE corner of SE1/4, Section 33, T. 20 N., R. 5 W., on public land.

d. Two homes on the NE1/4, Section 5, T. 19 N., R. 5 W., on public land.

BISTI #1 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Bisti #1 Tract, approximately 3,560 acres in size, is located 35 miles southeast of Farmington, New Mexico. Of the total 3,560 acres for land surface 2,840 acres are unleased Federal, 320 acres are State and 400 acres are private. The acreages for the coal reserves are 3,560 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 150.0 million tons with the tract total of 150 million tons. The recoverable reserves tonnage of unleased Federal is 127 million tons with the tract total of 127 million tons. The expected production rate would be 3.2 million tons per year for a projected mine life of 42 years. Total expected revenue from federal coal within the tract is $2.54 billion with an expected federal royalty value of $318 million for the life of the mine. Approximately 89 surface acres would be disturbed annually for unleased Federal coal. Surface disturbance over the life of the mine would total 3,560 acres for unleased Federal Coal.

Approximately 240 employees would be needed to mine the reserves. The mining activities would require approximately 200 acre feet/year of water from deep wells for reclamation and dust control.

Impacts to ground water would result from destruction of the stratified nature of the Fruitland formation overburden and layers above the Pictured Cliff Sandstone. These would be replaced with crumbled shale and sandstone rubble of a greater porosity. This may result in upward leakage from the underlying Pictured Cliffs Sandstone which contains water of a much greater salinity. There is also a possibility of a lowering of water levels in wells tapping the same aquifers in the vicinity of the tract.

Paleontological resources would be impacted by the disturbance of an estimated 290 fossil localities.

Five cultural resource sites and 43 predicted sites would be destroyed by mining activities.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

Three grazing allotments would be impacted by mining operations. Surface disturbance would cause a loss of 377 AUM's/year of native forage over the life of the mine. Livestock improvements that would be impacted (destroyed) during mining operations include 1 water well and 3 reservoirs.

BISTI #2 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Bisti #2 Tract, approximately 1,130 acres in size, is located 30 miles south of Farmington, New Mexico. Of the total 1,130 acres for land surface 390 acres are unleased Federal, and 740 acres are private. The acreages for the coal reserves are 1,130 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 64 million tons with the tract total of 64 million tons. The recoverable reserves tonnage of unleased Federal is 54 million tons with the tract total of 54 million tons. The expected production rate would be 82 million tons per year for a projected mine life of 38 years. Total expected revenue from federal coal within the tract is $1.1 billion with an expected federal royalty value of $137.5 million for the life of the mine. Approximately 82 surface acres would be disturbed annually for unleased Federal coal. Surface disturbance over the life of the mine would total 1,130 acres for unleased Federal Coal.

Approximately 115 employees would be needed to mine the reserves. The mining activities would require approximately 20 acre feet/year of water from deep wells for reclamation and dust control.

Impacts to ground water would result from destruction of the stratified nature of the Fruitland formation overburden and all confining layers above the Pictured Cliffs Sandstone. These would be replaced with crumbled shale and sandstone rubble of a greater porosity. This may result in upward leakage from the underlying Pictured Cliffs Sandstone which contains water of a much greater salinity. There is also a possibility of a lowering of the water level in wells tapping the same aquifers in the vicinity of the tract. There would be less runoff locally to alluvial channels downstream and possibly less recharge to ground water in the alluvium. Disturbance would include 87 acres of the Hunter Wash floodplain.

Another significant impact to resources is the disturbance of 11 fossil localities per year totaling 274 for the life of the mine.

Solitude and naturalness in the Bisti and Ah-shi-sle-pah WSA would be disrupted by sights and sounds associated with the adjacent surface mining. Scenic badlands adjacent to the WSA's would be destroyed by mining.

Eight recorded archaeological sites and 12 predicted sites would be destroyed. Two buildings are located on the tract.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

One grazing allotment would be impacted by mining operations. Surface disturbance would cause a loss of 319 AUM's/year of native forage over the life of the mine.

CATALPA CANYON TRACT
MIXED OWNERSHIP - SURFACE MINE

The Catalpa Canyon Tract, approximately 1,040 acres in size, is located 2 to 3 miles southeast of Gallup, New Mexico. The total 1,040 acres of land surface are private. The acreages for the coal reserves are 120 acres unleased Federal and 920 acres for private.

The tract contains mineable reserves of unleased Federal at .4 million tons with the tract total of 8.4 million tons. The recoverable reserves tonnage of unleased Federal is .34 million tons with the tract total of 7.34 million tons. The expected production rate would be 2.5 million tons per year for a projected mine life of 5 years. Total expected revenue from federal coal within the tract is $6.8 million with an expected federal royalty value of $.85 million for the life of the mine. Approximately 40 surface acres would be disturbed annually for unleased Federal coal. Surface disturbance over the life of the mine would total 121 acres.

Approximately 8 employees would be needed to mine the reserves. The mining activities would require approximately 35 acre feet/year of water from deep wells for reclamation and dust control.

Impacts to ground water would result from destruction of the stratified nature of Dilco Coal Member of the Crevasse Canyon formation overburden and the confining layers above Gallup Sandstone. Replacement of these formations with crumbled shale and rubble of a greater porosity would result in downward leakage of water from the overlying Crevasse Canyon formation. This water is of a greater salinity than water at this location in the Gallup Sandstone. There is a possibility of lowering water tables and water quality in wells tapping the same aquifers in the vicinity of the tract. One existing water well within the tract would be destroyed. There would be less runoff locally to alluvial channels downstream and possibly less recharge to ground water in the alluvium.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

A sensitive state plant specie, Astragalus wingtagus, would be impacted by mining the tract. A more intense survey would be necessary to locate all specific habitat areas within the tract.

Two grazing allotments would be impacted by mining operations. Surface disturbance would cause a loss of 18 AUM's/year of native forage over the life of the mine.

SUNDANCE TRACT
MIXED OWNERSHIP - SURFACE MINE

The Sundance Tract, approximately 920 acres in size, is located 5 miles southeast of Gallup, New Mexico. The total 920 acres for land surface are private. The acreages for the coal reserves are 720 acres unleased Federal and 200 acres for private.

The tract contains mineable reserves of unleased Federal at 4.0 million tons with the tract total of 5.0 million tons. The recoverable reserves tonnage of unleased Federal is 3.0 million tons with the tract total of 4.0 million tons. The expected production rate would be 200,000 million tons per year for a projected mine life of 22 years. Total expected revenue from federal coal within the tract is $62 million with an expected federal royalty value of $7.75 million for the life of the mine. Approximately 23 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 458 acres.

Approximately 15 employees would be needed to mine the reserves. The mining activities would require approximately 15 acre feet/year of water from deep wells for reclamation and dust control.

Impacts to ground water would result from destruction of the stratified nature of the Dilco Coal Member of the Crevasse Canyon formation overburden and the confining layers above the Gallup Sandstone. Replacement of these formations with crumbled shale and rubble of a greater porosity would

result in downward leakage of water from the overlying Crevasse Canyon formation. This water is of a greater salinity than water at this location in the Gallup Sandstone. There is a possibility of lowering water tables and water quality in wells tapping the same aquifers in the vicinity of the tract. There would be less runoff locally to alluvial channels downstream and possibly less recharge to ground water in the alluvium.

Another significant impact to resources is the destruction of 17 known archaeological sites and approximately 6 predicted sites. Seven occupied dwellings are scattered throughout the tract.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

One grazing allotment would be impacted by mining operations. Surface disturbance would cause a loss of 56 AUM's/year of native forage over the life of the mine. Livestock improvements that would be impacted (destroyed) during mining operations include 1 water well and 1.5 miles of fence.

SAMSON LAKE #2 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Samson Lake #2 Tract, approximately 2,440 acres in size, is located 9 miles northwest of Gallup, New Mexico. Of the total 2,440 acres for land surface 320 acres are unleased Federal and 1,280 acres are private. The acreages for the coal reserves are 2,040 acres unleased Federal and 400 acres for private.

The tract contains mineable reserves of unleased Federal at 11.0 million tons with the tract total of 39.0 million tons. The recoverable reserves tonnage of unleased Federal is 9.0 million tons with the tract total of 9.37 million tons. The expected production rate would be 1.6 million tons per year for a projected mine life of 29 years. Total expected revenue from federal coal within the tract is $213.4 million with an expected federal royalty value of $26.68 million for the life of the mine. Approximately 7 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 140 acres.

Approximately 40 employees would be needed to mine the reserves. The mining activities would require approximately 50 acre feet/year from deep wells for reclamation and dust control.

If good operational procedures such as reduced vehicle speeds and dust controls are practiced by mine operators, the estimated maximum off-site, total suspended particulates (TSP) would be 20 micro grams per cubic meter (ug/m^3). The background air quality in the area is estimated at 30 ug/m^3. This would give a total of approximately 50 ug/m^3. The air quality could exceed the annual New Mexico standard if good operational procedures are not instituted.

Impacts to ground water would result from destruction of the stratified nature of the Dilco Coal Member of the Crevasse Canyon formation overburden and the confining layers above the Gallup Sandstone. Replacement of these formations with crumbled shale and rubble of a greater porosity would result in downward leakage of water from the overlying Crevasse Canyon formation. This water is of a greater salinity than water at this location in the Gallup Sandstone. There is a possibility of lowering water tables and water quality on wells tapping the same aquifers in the vicinity of the tract. One existing water well within the tract would be destroyed. Runoff locally to alluvial channels downstream would be reduced and there would be less recharge to ground water in the alluvium.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

One cultural site and between 16 and 73 predicted sites would be destroyed by surface mining. Fifteen Navajo dwellings are scattered throughout the tract.

Two grazing allotments would be impacted by mining operations. Surface disturbance would cause a loss of 19 AUM's/year of native forge over the life of the mine.

LA PLATA #3 TRACT
MIXED OWNERSHIP - SURFACE MINE

The La Plata #3 Tract, approximately 240 acres in size, is located 20 miles north of Farmington, New Mexico. Of the total 240 acres for land surface 160 acres are unleased Federal, 40 acres are State and 40 acres are private. The acreages for the coal reserves are 200 acres unleased Federal and 40 acres for State.

The tract contains mineable reserves of unleased Federal at 2.0 million tons with the tract total of 5.0 million tons. The recoverable reserves tonnage of unleased Federal is 2.0 million tons with the tract total of 4.0 million tons. The expected production rate would be 0.4 million tons per year for a projected mine life of 12 years. Total expected revenue from federal coal within the tract is $40 million with an expected federal royalty value of $5 million for the life of the mine. Approximately 16 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 160 acres.

Approximately 31 employees would be needed to mine the reserves. The mining activities would require approximately 100 acre feet/year of water from deep wells for reclamation and dust control.

Impacts to ground water would result from destruction of the stratified nature of the Fruitland formation overburden and all confining layers above the Pictured Cliff Sandstone. These would be replaced with crumbled shale and sandstone rubble of a greater porosity. This may result in

upward leakage from the underlying Pictured Cliffs Sandstone which contains water of a much greater salinity. There is also a possibility of a lowering of water levels in wells tapping the same aquifers in the vicinity of the tract. There would be less runoff locally to alluvial channels downstream and possibly less recharge to ground water in the alluvium.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

Approximately 100 acres of the tract are used by wintering mule deer and elk from December 1 through March 31. Mining would result in forced movements of wintering wildlife due to stress.

Three archaeological sites would be destroyed by mining activities. Other sites could exist since less than 4% of the tract has been inventoried.

One grazing allotment would be impacted by mining operations. Surface disturbance would cause a loss of 21 AUM's/year of native forage over the life of the mine.

LA PLATA #4 TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The La Plata #4 Tract, approximately 600 acres in size, is located 15 miles north of Farmington, New Mexico. Of the total 600 acres for land surface 240 acres are unleased Federal and 360 acres are private. The acreages for the coal reserves are 600 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 20 million tons with the tract total of 20 million tons. The recoverable reserves tonnage of unleased Federal is 10 million tons with the tract total of 10 million tons. The expected production rate would be .50 million tons per year for a projected mine life of 23 years. Total expected revenue from federal coal within the tract is $252.2 million with an expected federal royalty value of $20.2 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 125 employees would be needed to mine the reserves. The mining activities would require approximately 40 acre feet/year of water from deep wells for mining operations.

Impacts to ground water would result from subsidence disrupting overlying bedrock aquifers in the Fruitland formation. Fracturing would cause contamination of aquifers in the alluvial and Fruitland formations. Water utilized in the mining operation would cause a lowering of water levels in wells tapping the same aquifers. Water seepage from the Pictured Cliffs Sandstone into the mine could affect yield and water level in a water well located west of the tract.

A Federal Threatened or Endangered Plant species habitat, Castillija chromosa, could be impacted by placement of surface facilities. A more intense survey would be necessary to locate all specific habitat areas within the tract.

Five archaeological sites could be damaged or destroyed by mine subsidence. The largest site (LA 5605) is an Anasazi site with at least six room blocks, approximately 500 feet x 3,500 feet.

Two grazing allotments would be impacted by mining operations. Surface disturbance would cause a loss of 4 AUM's/year of native forage over the life of the mine. One livestock reservoir could be impacted by placement of surface facilities or subsidence.

STAR LAKE EAST #2 (LC) TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The Star Lake East #2 (LC) Tract, approximately 1,760 acres in size, is located 85 miles south of Farmington, New Mexico. Of the total 1,760 acres for land surface 1,600 acres are unleased Federal and 160 acres are private. The acreages for the coal reserves are 1,760 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 64.0 million tons with the tract total of 64.0 million tons. The recoverable reserves tonnage of unleased Federal is 21 million tons with the tract total of 21 million tons. The expected production rate would be 1.0 million tons per year for a projected mine life of 24 years. Total expected revenue from federal coal within the tract is $517.5 million with an expected federal royalty value of $41.4 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 250 employees would be needed to mine the reserves. The mining activities would require approximately 23 acre feet/year of water from deep wells for mining operations.

Mine subsidence would fracture overlying bedrock aquifers in the Fruitland and Ojo Alamo Sandstone formations. This would reduce well yields, water levels, and possibly water quality of wells located in the vicinity of the tract.

One dwelling is located within the tract. An area considered by Navajo Indians to be sacred is located within the tract, but no definite boundaries have been established. Placement of surface facilities would impact the sacred area.

Between 15 and 31 archaeological sites have been predicted within the tract. These sites could be damaged or destroyed by placement of surface facilities.

Sights and sounds associated with the mining operation could disrupt the aesthetics along the Continental Divide National Scenic Trail.

One grazing allotment would be impacted by mining operations. Surface disturbance would cause a loss of 7 AUM's/year of native forage over the life of the mine.

CROWNPOINT NORTHEAST TRACT
MIXED OWNERSHIP - SURFACE MINE

The Crownpoint Northeast Tract, approximately 8,800 acres in size, is located 5 miles northeast of Crownpoint, New Mexico. Of the total 8,800 acres for land surface 560 acres are unleased Federal, 520 acres are State, 4,560 acres are private, and 3,160 acres are withdrawn by Public Land Order 2198 for Indian use. The acreages for the coal reserves are 8,280 acres unleased Federal, and 520 acres for State.

The tract contains mineable reserves of unleased Federal at 150.0 million tons with the tract total of 150.0 million tons. The recoverable reserves tonnage of unleased Federal is 94.0 million tons with the tract total of 94.0 million tons. The expected production rate would be 2.4 million tons per year for a projected mine life of 41 years. Total expected revenue from federal coal within the tract is $1.88 billion with an expected federal royalty value of $235 million for the life of the mine. Approximately 206 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 8,238 acres.

Approximately 285 employees would be needed to mine the reserves. The mining activities would require approximately 125 acre feet/year of water from deep wells for reclamation and dust control.

Air quality would be impacted by an increase in total suspended particulates (TSP) of 29 micro grams per cubic meter (ug/m3). Background air quality in the area is estimated at 30 ug/m3. This would result in a total of 59 ug/m3, with the the annual New Mexico standard being 60 ug/3.

Impacts to ground water would result from the destruction of the stratified nature of the Menefee formation and all confining layers above the Point Lookout Sandstone. These would be replaced by crumbled shale and sandstone rubble of a greater porosity. This may result in upward leakage of water from the underlying Point Lookout Sandstone causing a greater salinity in water of the Menefee formation. There is a possibility of a lowering water levels, well yields, and changes in water quality in wells tapping these formations.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

Paleontological resources would be impacted by the destruction of three significant fosssil sites.

There are 37 dwellings scattered throughout the tract.

No known sites have been found. However predictions of approximately 110 sites have been projected from inventories conducted adjacent to the tract. These sites would be destroyed by mining.

One grazing allotment would be impacted by mining operations. Surface disturbance would cause a loss of 948 AUM's/year of native forage over the life of the mine. Livestock improvements to be impacted (destroyed) during mining operations include 3 waterwells, 8.5 miles of water pipelines, and 3 livestock reservoirs.

CROWNPOINT EAST TRACT
MIXED OWNERSHIP - SURFACE MINE

The Crownpoint East Tract, approximately 10,640 acres in size, is located 6 miles east of Crownpoint, New Mexico. Of the total 10,640 acres for land surface 160 acres are unleased Federal and 5,620 acres are private, and 4,560 acres are withdrawn by Public Land Order 2198 for Indian use. The acreages for the coal reserves are 9,880 acres unleased Federal and 760 acres for private.

The tract contains mineable reserves of unleased Federal at 149.0 million tons with the tract total of 278.0 million tons. The recoverable reserves tonnage of unleased Federal is 124.0 million tons with the tract total of 129.0 million tons. The expected production rate would be 6.76 million tons per year for a projected mine life of 21 years. Total expected revenue from federal coal within the tract is $2.47 billion with an expected federal royalty value of $308 million for the life of the mine. Approximately 261 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 10,440 acres.

Approximately 216 employees would be needed to mine the reserves. The mining activities would require approximately 250 acre feet/year of water from deep wells for reclamation and dust control.

Air quality would be impacted by an increase in total suspended particulates (TSP) of 46 micro grams per cubic meter (ug/m3). Background air quality in the area is estimated at 30 ug/m3. This would result in a total 76 ug/m3, exceeding the annual New Mexico standard by 16 ug/m3.

Impacts to ground water would result from the destruction of the stratfied nature of the Menefee formation and all confining layers above the Point Lookout Sandstone. These would be replaced by crumbled shale and sandstone rubble of a greater porosity. This may result in upward leakage of water from the underlying Point Lookout Sandstone causing a greater salinity in water of the Menefee formation. There is a possibility of a lowering water levels, well yields, and changes in water quality in wells tapping these formations.

Surface disturbance on this tract would increase erosion, soil contamination, changing soils characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

Paleontological resources would be impacted by the destruction of three recorded fossil sites and any existing potentially important sites.

Sights and sounds associated with the mining operations could disrupt the aesthetics along the Continental Divide National Scenic Trail.

There are 25 dwellings scattered throughout the tract. These dwellings would be destroyed by mining.

One grazing allotment would be impacted by mining operations. Surface disturbance would cause a loss of 1,196 AUM's/year of native forge over the life of the mine. Livestock improvements to be impacted (destroyed) during mining operations include 1 waterwell, 19.5 miles of fence, and 2 livestock reservoirs.

CHICO WASH SOUTH TRACT
MIXED OWNERSHIP - SURFACE MINE

The Chico Wash South Tract, approximately 12,190 acres in size, is located 30 miles Northeast of Grants, New Mexico. Of the total 12,190 acres for land surface 10,070 acres are unleased Federal, 40 acres are State and 2,080 acres are private. The acreages for the coal reserves are 11,670 acres unleased Federal, 40 acres for State and 480 acres for private.

The tract contains mineable reserves of unleased Federal at 74.0 million tons with the tract total of 80 million tons. The recoverable reserves tonnage of unleased Federal is 63.0 million tons with the tract total of 71.0 million tons. The expected production rate would be 1.8 million tons per year for a projected mine life of 42 years. Total expected revenue from federal coal within the tract is $1.31 billion with an expected federal royalty value of $164 million for the life of the mine. Approximately 148 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 5,907 acres.

Approximately 120 employees would be needed to mine the reserves. The mining activities would require approximately 400 acre feet/year of water from deep wells for reclamation and dust control.

Air quality would be impacted by an increase in total suspended particles (TSP) of 23 micro grams per cubic meter (ug/m^3). Background air quality in the area is estimated at 30 ug/m^3. This would result in a total of 53 ug/m^3, with the annual New Mexico standard being 60 ug/m^3.

Impacts to ground water would result from destruction of the Menefee formation (Cleary Coal Member) overburden and confining layers above the Point Lookout Sandstone. Leakage of poorer quality water from the overlying Menefee

into the Point Lookout Sandstone would occur. The Point Lookout aquifer is of particular significance because of the high chemical quality of water and importance as a major aquifer for the San Juan Basin. One BLM water well and one private well located within the tract would be destroyed. Two BLM wells tapping the Point Lookout Sandstone and one BLM well tapping the Gallup Sandstone aquifer would be impacted by reduction of well yields, lowering of water levels, and possible changes in water quality. Eight springs within the tract would be destroyed by mining since water originates in the Cleary Coal Member of the Menefee formation. Two of these springs, Ojo Azabache and Coal Spring have been declared as Public Water Reserves. Arroyo Chico is a perennial stream due to discharge of uranium mine water from the San Mateo area. The stream flow of 3 to 4 cubic feet per second would be difficult to impound or divert and erosion would increase after reclamation.

An interesting historical site, Azabache Station, that provides historical sightseeing opportunities would be destroyed by mining operations. Four archaeological sites that have been recorded within the tract would be destroyed.

Surface disturbance on this tract would increase erosion, soil contaimination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling, and reclamation.

One grazing allotment would be impacted by mining operation. Surface disturbance would cause a loss of 925 AUM's/year of native forage over the life of the mine. Livestock improvements to be impacted (destroyed) during mining operations include three waterwells, 10.5 miles of fence, and five livestock reservoirs.

TA-HA-BAH WELL TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The Ta-Ha-Bah Well Tract, approximately 3,080 acres in size, is located 6 miles south of Gallup, New Mexico. The total 3,080 acres for land surface are private. The acreages for the coal reserves are 3,080 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 23 million tons with the tract total of 23 million tons. The recoverable reserves tonnage of unleased Federal is 12 million tons with the tract total of 12 million tons. The expected production rate would be 1.2 million tons per year for a projected mine life of 13 years. Total expected revenue from federal coal within the tract is $352.5 million with an expected federal royalty value of $28.2 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 175 employees would be needed to mine the reserves. The mining activities would require approximately 40 acre feet per year of water from deep wells for mining operations.

Mine subsidence would fracture ovelying bedrock aquifers in the Crevasse Canyon formation. This would reduce well yields, water levels, and possibly water quality of wells located in the vicinity of the tract. Two known wells exist within the tract. Mine subsidence and/or dewatering would affect the quantity and quality of water available to these and other wells in the vicinity.

No known archaeological sites have been recorded within the tract, however, projections of inventories conducted near the tract indicate approximately 67 predicted sites could exist. The sites could be destroyed by placement of surface facilities or fractured by mine subsidence.

There are 21 dwellings scattered throughout the tract. Mine subsidence could create safety hazards and damage to dwellings.

Two grazing allotments would be impacted by mining operations. Surface disturbance would cause a loss of 9 AUM's/year of native forage over the life of the mine.

HOGBACK TRACT
MIXED OWNERSHIP - SURFACE MINE

The Hogback Tract, approximately 1,760 acres in size, is located 4 miles southeast of Gallup, New Mexico. Of the total 1,760 acres for land surface 360 acres are unleased Federal and 1,400 acres are private. The acreages for the coal reserves are 1,760 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 5.0 million tons with the tract total of 5.0 million tons. The recoverable reserves tonnage of unleased Federal is 4.0 million tons with the tract total of 4.0 million tons. The expected production rate would be 200,000 million tons per year for a projected mine life of 23 years. Total expected revenue from federal coal within the tract is $86 million with an expected federal royalty value of $10.8 million for the life of the mine. Approximately 43 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 898 acres.

Approximately 15 employees would be needed to mine the reserves. The mining activities would require approximately 45 acre feet/year of water from deep wells for reclamation and dust control.

Impacts to ground water would result from destruction of the stratified nature of the Dilco Coal Member of the Crevasse Canyon formation overburden and the confining layers above the Gallup Sandstone. Replacement of these formations with crumbled shale and rubble of a greater porosity would result in downward leakage of water from the overlying Crevasse Canyon formation. This water is of a greater salinity than water at this location in the Gallup Sandstone. There is a possibility of lowering water tables and water quality in wells tapping the same aquifers in the vicinity of the tract. One existing water well within the tract would be destroyed. There would be less runoff locally to alluvial channels downstream and possibly less recharge to ground water in the alluvium.

Surface disturbance on this tract would increase erosion. Soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

No archeological sites are known to have been recorded in the tract; however, approximately 39 sites have been predicted from inventoried conducted near the tract. These sites would be destroyed by mining.

A federal listed Threatened and Endangered plant species, Astragalas wingatus, may ocurr within the tract according to a township survey of possible occurrence. If present his specie would be destroyed.

Seventeen dwellings and one developed trailer park are located within the tract. The trailer park is located in the extreme northwestern portion of the tract and could be dropped from lease consideration without affecting access to the trailer park. Fourteen of the 17 homes are concentrated in SW1/4 of Section 19, T. 15 N., R. 18 W., NMPM. The SW1/4 of Section 19 is the only portion of Section 19 that was delineated as the tract and could possibly be dropped from lease consideration.

Two grazing allotments would be impacted by mining operations. Surface disturbance would cause a loss of 107 AUM's/year of native forage over the life of the mine.

TWIN BUTTES TRACT
MIXED OWNERSHIP - SURFACE MINE

The Twin Buttes Tract, approximately 8,800 acres in size, is located 6 miles southwest of Gallup, New Mexico. Of the total 8,800 acres for land surface 320 acres are unleased Federal and 4,790 acres are private, and 3,690 acres are withdrawn by Public Land Order 2198 for Indian Use. The acreages for the coal reserves are 8,640 acres unleased Federal and 160 acres for private.

The tract contains mineable reserves of unleased Federal at 68.0 million tons with the tract total of 68.0 million tons. The recoverable reserves tonnage of unleased Federal is 30.0 million tons with the tract total of 30.0 million tons. The expected production rate would be 1.4 million tons per year for a projected mine life of 22 years. Total expected revenue from federal coal within the tract is $574 million with an expected federal royalty value of $71.8 million for the life of the mine. Approximately 250 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 5,000 acres.

Approximately 75 employees would be needed to mine the reserves. The mining activities would require approximately 165 acre feet/year of water from deep wells for reclamation and dust control.

Air quality would be impacted by an increase in total suspended particulates (TSP) of 30 micro grams per cubic meter (ug/m3). Background

air quality in the area is estimated at 30 ug/m3. This would result in a total of 60 ug/m3 reaching the annual New Mexico standard of 60 ug/m3.

Impacts to ground water would result from destruction of the stratified nature of the Dilco Coal Member of the Crevasse Canyon formation overburden and the confining layers above the Gallup Sandstone. Replacement of these formations with crumbled shale and rubble of a greater porosity would result in downward leakage of water from the overlying Crevasse Canyon formation. This water is of a greater salinity than water at this location in the Gallup Sandstone. There is a possibility of lowering water tables and water quality in wells tapping the same aquifers in the vicinity of the tract. Four existing water wells within the tract would be destroyed. There would be less runoff locally to alluvial channels downstream and possibly less recharge to ground water in the alluvium.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

There are 19 recorded fossil localities within the tract with a potential for discovery of important material discoveries in these exposures.

No known archaeological sites have been recorded; however, one petroglyph site exists and 234 archaeological sites have been predicted within the tract. These sites would be destroyed by mining.

There are 93 dwellings scattered through out this tract. These dwellings would be destroyed by mining and relocation would be necessary.

Two grazing allotments would be impacted by mining operations. Surface disturbance would cause a loss of 584 AUM's/year of native forage over the life of the mine. Livestock improvements that would be impacted (destroyed) during mining operations include 1 water well and 2.5 miles of water pipeline.

PINEHAVEN TRACT
MIXED OWNERSHIP - SURFACE MINE

The Pinehaven Tract, approximately 20,400 acres in size, is located 18 miles south of Gallup, New Mexico. Of the total 20,400 acres for land surface 1,120 acres are State and 19,280 acres are private. The acreages for the coal reserves are 9,680 acres unleased Federal, 1,120 acres for State and 9,600 acres for private

The tract contains mineable reserves of unleased Federal at 7 million tons with the tract total of 6 million tons. The recoverable reserves tonnage of unleased Federal is 6 million tons with the tract total of 6 million tons. The expected production rate would be .29 million tons per year for a projected mine life of 23 years. Total expected revenue from federal coal within the tract is $126 million with an expected federal royalty value of

$15.75 million for the life of the mine. Approximately 29 surface acres would be disturbed annually for unleased Federal coal. Surface disturbance over the life of the mine would total 588 acres for unleased Federal Coal.

Approximately 24 employees would be needed to mine the reserves. The mining activities would require approximately 35 acre feet/year of water from deep wells for reclamation and dust control.

Impacts to ground water would result from destruction of the stratified nature of the Dilco Coal Member of the Crevasse Canyon formation overburden and the confining layers above the Gallup Sandstone. Replacement of these formations with crumbled shale and rubble of a greater porosity would result in downward leakage of water from the overlying Crevasse Canyon formation. This water is of a greater salinity than water at this location in the Gallup Sandstone. There is a possibility of lowering water tables and water quality in wells tapping the same aquifers in the vicinity of the tract. Seven existing water wells within the tract would be destroyed. There would be less runoff locally to alluvial channels downstream and possibly less recharge to groundwater in the alluvium.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

Nineteen recorded archaeological sites and 191 predicted sites would be destroyed by mining.

There are 107 dwellings located within the tract. Fifty dwellings are located on Navajo Tribal land of Section 16, T. 13 N., R. 17 W., NMPM. Section 16 is located in the extreme northeastern edge of the tract, with only the south boundary adjacent to the remainder of the tract. If this section is dropped from lease consideration, nearly 50% of the homes within this tract would not be relocated. The remaining 57 dwellings are scattered throughout the tract.

One grazing allotment would be impacted by mining operations. Surface disturbance would cause a loss of 72 AUM's/year of native forge over the life of the mine.

BREAD SPRINGS #1 TRACT
MIXED OWNERSHIP - SURFACE MINE

The Bread Springs #1 Tract, approximately 1,116 acres in size, is located 7 miles southeast of Gallup, New Mexico. Of the total 1,116 acres for land surface 160 acres are State and 956 acres are private. The acreages for the coal reserves are 636 acres unleased Federal, 160 acres for State and 320 acres for private.

The tract contains mineable reserves of unleased Federal at 1.0 million tons with the tract total of 2.0 million tons. The recoverable

reserves tonnage of unleased Federal is 1.0 million tons with the tract total of 2.0 million tons. The expected production rate would be .04 million tons per year for a projected mine life of 21 years. Total expected revenue from federal coal within the tract is $14 million with an expected federal royalty value of $1.8 million for the life of the mine. Approximately 5.9 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 118 acres.

Approximately 3 employees would be needed to mine the reserves. The mining activities would require approximately 20 acre feet/year of water from deep wells for reclamation and dust control.

Impacts to ground water would result from destruction of the stratified nature of the Dilco Coal Member of the Crevasse Canyon formation overburden and the confining layers above the Gallup Sandstone. Replacement of these formations with crumbled shale and rubble of a greater porosity would result in downward leakage of water from the overlying Crevasse Canyon formation. This water is of a greater salinity than water at this location in the Gallup Sandstone. There is a possibility of lowering water tables and water quality in wells tapping the same aquifers in the vicinity of the tract.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

No paleontological data is available on the tract, however, surveys on adjacent lands produced over 30 fossil sites. Several of these sites are highly significant since the Crevasse Canyon fossils are rare and unstudied. Potentially significant fossils would be destroyed by mining this tract.

No known archaeological sites exist within the tract, however, approximately 16 predicted sites would be destroyed by mining.

There are 17 dwellings scattered throughout the tract that would have to be relocated.

One grazing allotment would be impacted by mining operations. Surface disturbance would cause a loss of 19 AUM's/year of native forage over the life of the mine.

BREADSPRINGS #2 TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The Bread Springs #2 Tract, approximately 1,040 acres in size, is located 7 miles southeast of Gallup, New Mexico. The total 1,040 acres of land surface are private. The acreages for the coal reserves are 1,040 acres unleased Federal.

The tract contains mineable reserves of unleased Federal at 10 million tons with the tract total of 12 million tons. The recoverable reserves

tonnage of unleased Federal is 5 million tons with the tract total of 7 million tons. The expected production rate would be .14 million tons per year for a projected mine life of 50 years. Total expected revenue from federal coal within the tract is $135 million with an expected federal royalty value of $1.08 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 27 mining employees would be needed to mine the reserves. The mining activities would require approximately 30 acre feet/year of water from deep wells for mining operations.

Impacts to ground water would result from subsidence fracturing overlying bedrock aquifers in the Crevasse Canyon formation. Utilization of water for mine operations and formation fracturing could reduce water yields, levels, and water quality in wells tapping the Crevasse Canyon aquifer.

No paleontological data is available on the tract, however, surveys on adjacent lands produced over 30 fossil sites. Several of these sites are highly significant since the Crevasse Canyon fossils are rare and unstudied. Potentially significant fossils would be destroyed by mining this tract.

No known archaeological sites exist within the tract, however, approximately 27 predicted sites would be destroyed by mining.

One grazing allotment would be impacted by mining operations. Surface disturbance would cause a loss of 9 AUM's/year of native forage over the life of the mine.

GAMERCO #1 (LC) TRACT
MIXED OWNERSHIP - SURFACE MINE

The Gamerco #1 (LC) Tract, approximately 320 acres in size, is located 9 miles northwest of Gallup, New Mexico. Of the total 2,440 acres for land surface 320 acres are unleased Federal and 320 acres are private. The acreages for the coal reserves are 160 acres unleased Federal and 160 acres for private.

The tract contains mineable reserves of unleased Federal at 2.0 million tons with the tract total of 3.0 million tons. The recoverable reserves tonnage of unleased Federal is 3.0 million tons with the tract total of 4.0 million tons. The expected production rate would be 95,000 tons per year for a projected mine life of 22 years. Total expected revenue from federal coal within the tract is $38 million with an expected federal royalty value of $4.75 million for the life of the mine. Approximately 4 surface acres would be disturbed annually. Surface disturbance over the life of the mine would total 75 acres.

Approximately 10 employees would be needed to mine the reserves. The mining activities would require approximately 30 acre feet/year of water from deep wells for reclamation and dust control.

Impacts to ground water would result from destruction of the stratified nature of the Dilco Coal Member of the Crevasse Canyon formation overburden and the confining layers above the Gallup Sandstone. Replacement of these formations with crumbled shale and rubble of a greater porosity would result in downward leakage of water from the overlying Crevasse Canyon formation. This water is of a greater salinity than water at this location in the Gallup Sandstone. There is a possibility of lowering water tables and water quality in wells tapping the same aquifers in the vicinity of the tract. There would be less runoff locally to alluvial channels downstream and possibly less recharge to ground water in the alluvium.

Surface disturbance on this tract would increase erosion, soil contamination, changing soil characteristics and possible loss or destruction of suitable soils which may occur during overburden removal, stockpiling and reclamation.

No known archaeological sites have been recorded, but 13 predicted sites would be destroyed by mining.

Two dwellings are located within the tract and would have to be relocated.

Two grazing allotments would be impacted by mining operations. Surface disturbance would cause a loss of 13 AUM's/year of native forage over the life of the mine.

GAMERCO #2 (LC) TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The Gamerco #2 (LC) Tract, approximately 4,480 acres in size, is located 9 miles northwest of Gallup, New Mexico. Of the total 4,480 acres for land surface 40 acres are unleased Federal, 160 acres are State and 4,280 acres are private. The acreages for the coal reserves are 2,120 acres unleased Federal, 160 acres for State and 2,200 acres for private.

The tract contains mineable reserves of unleased Federal at 17 million tons with the tract total of 36 million tons. The recoverable reserves tonnage of unleased Federal is 8 million tons with the tract total of 17 million tons. The expected production rate would be 1.8 million tons per year for a projected mine life of 13 years. Total expected revenue from federal coal within the tract is $415 million with an expected federal royalty value of $33.2 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 208 mining employees would be needed to mine the reserves. The mining activities would require approximately 60 acre feet/year of water from deep wells for mining operations.

Impacts to ground water would result from subsidence fracturing the Crevasse Canyon and Menefee formations. Water utilized in the mining

operation and subsidence would cause reduced well yields, water levels, and water quality in wells tapping the Crevasse Canyon and Menefee formations.

No archaeological sites are known to have been recorded in the tract, however, between 17 and 76 sites have been predicted from inventories conducted near the tract. These sites would be destroyed by mining.

Thirty five dwellings are located within the tract and would have to be relocated to avoid the possibility of subsidence damage.

Two grazing allotments would be impacted by mining operations. Surface disturbance would cause a loss of 9 AUM's/year of native forage over the life of the mine.

SAMSON LAKE #1 (LC) TRACT
MIXED OWNERSHIP - UNDERGROUND MINE

The Samson Lake #1 (LC) Tract, approximately 5,600 acres in size, is located 9 miles east-northeast of Gallup, New Mexico. Of the total 5,600 acres for land surface 680 acres are unleased Federal, 80 acres are State and 4,840 acres are private. The acreages for the coal reserves are 4,080 acres unleased Federal, 80 acres for State and 1,440 acres for private.

The tract contains mineable reserves of unleased Federal at 27 million tons with the tract total of 35 million tons. The recoverable reserves tonnage of unleased Federal is 13 million tons with the tract total of 13 million tons. The expected production rate would be 700,000 tons per year for a projected mine life of 23 years. Total expected revenue from federal coal within the tract is $350 million with an expected federal royalty value of $28 million for the life of the mine. A maximum of 80 surface acres would be disturbed over the life of the underground mine for placement of the related surface facilities.

Approximately 175 employees would be needed to mine the reserves. The mining activities would require approximately 60 acre feet/year of water from deep wells for mining operations.

Impacts to ground water would result from subsidence fracturing the Crevasse Canyon and Menefee formations. Water utilized in the mining operation and subsidence would cause reduced well yields, water levels, and water quality in wells tapping the Crevasse Canyon and Menefee formations. Three known wells located within the tract are completed to the Gallup Sandstone formation. If dewatering of the mine is necessary, the yields and water levels of these wells and water wells outside the tract would be reduced.

One recorded archaeological site and up to 147 predicted sites would be destroyed or damaged by surface facilities or subsidence.

There are 33 dwellings that would have to be relocated to avoid safety hazards or damage to homes due to subsidence,

One grazing allotment would be impacted by mining operations. Surface disturance would cause a loss of 9 AUM's/year of native forage over the life of the mine.

APPENDIX A-2

COAL PROGRAM IMPLEMENTATION TO DATE

The following narrative summarizes the implementation of the federal coal program in the San Juan River Coal Region and presents the history and background leading to the publication of this EIS.

The BLM in New Mexico has developed a land use plan that identifies lands acceptable for competitive coal leasing. Coal-bearing lands of high, moderate, and low development potential were examined to determine their acceptability. Trade-offs with other possible uses were analyzed. The tracts analyzed in this EIS were found suitable for mining. (Documentation of this land use planning process is on file at the BLM's Resource Area Office in Farmington, New Mexico).

The surface owner consultation process was initiated during the BLM's land use planning. Surface owners in the San Juan River Region were consulted about their preference for coal mining on or adjacent to their lands. The response of the surface owners was not considered binding or contractual. Prior to lease sale, industry will be responsible for acquiring formal surface owner consent to mine tracts with private surface overlying federal coal.

On January 26, 1981, the Department of Energy (DOE) established its final goals for national and regional coal production, which included projected goals for the San Juan River Regional Coal Production. Two public hearings were held on the goals projected for the San Juan River Region in July 1981 during an 81-day public comment period. These goals were adopted by the Department of Interior (DOI) in November 1981.

A call for expression of leasing interest was issued by the BLM in September, 1981. Ten companies filed expressions of interest on approximately 2.3 billion tons. One company withdrew its expression of interest (900 million tons), reducing the total expression of interest to 1.9 billion tons. (Information provided by industry is on file with the BLM Albuquerque District Office.)

At an April 1982 meeting the team considered the tract profiles along with the criteria developed at the March meeting and independently prepared federal and state tract ranking reports. The RCT ranked the tracts and selected the alternatives by tract to be considered in the EIS.

APPENDIX A-3

TRACT DELINEATION, SELECTION, AND RANKING

The expressions of industry interest (refer to Appendix A-2) and other geologic and mining information were used by the Minerals Management Service (MMS) to delineate 50 tracts for potential leasing. The tract delineation reports include identification of the coal resources, the annual production potential of each tract, the degree of certainty of the coal data, the expected type of mining, employment required to develop and operate the tract, acreage disturbed, and other information. This information was used to develop a site-specific analysis by the BLM to assess the environmental, social, and economic factors pertinent to or affected by development of each tract. (These analyses are available for review at the Farmington Resource Area Office of the BLM.)

Table A-3-1 presents the factors developed by the RCT for track ranking. Using these factors, each of the 50 tracts were first evaluated by a six-member team of BLM employees from the New Mexico State Office, the Albuquerque District Office, and the Farmington Resource Area Office. These tracts were also evaluated by an independent 14-member team of state employees. Both evaluations were based on geologic, mineral, and engineering information from the tract delineation reports and major impacts from the site-specific analyses for each tract. This information was provided to each member of the RCT, along with maps and other data for use in the tract ranking.

On April 20 and 21, 1982, the RCT met to review the state and federal staff ranking recommendations. Based on the factors listed in Table A-3-1, the RCT ranked the tracts and made a determination of which tracts should be grouped together, arriving at four different leasing levels. These leasing levels have been incorporated into this EIS as four alternatives.

The relative rank of the tracts is portrayed in the range of alternatives. The lower production alternatives contain the most desirable tracts, and the successively higher production alternatives add the less desirable tracts.

Of the original 50 tracts delineated, 39 were carried forward for further leasing and ranking. The summary ranking for each tract is shown in Table A-3-2. Six of the 50 tracts were combined to make three: Bisti #6 and #8 became Bisti #6, Crownpoint East (LC) and Crownpoint East (HC) became Crownpoint East, and Samson Lake #2 (LC) and Samson Lake #2 became Samson Lake #2. Two tracts were recommended as public body tracts (Nageezi and Twin Buttes), and seven tracts were delineated by MMS as small business tracts (Johnson Trading Post, Sundance, Tah-ha-bah Well, Hogback, Pinehaven, Bread Springs #1 and Bread Springs #2).

A more detailed discussion of the ranking and selection processes is contained in the minutes of the RCT meetings held on April 20-21, which are available at the BLM New Mexico State Office in Santa Fe.

TABLE A-3-1

TRACT RANKING FACTORS

Coal Economics	Natural Environment	Socioeconomics
Coal Quantity	Air Quality	Public Attitudes
Coal Quality	Water Quality	Revenue Generation
Energy Production Potential	Wildlife	Lifestyle and Social Structure
Transporation	Reclamation Potential	Community and Social Structure
Surface Ownership	Archaeology	Unsuitability Criteria
	Paleontology	Consistency with Other Plans & Policies
	Historic Properties	Agricultural Operations
	Other Unique Resources	Relocation of Occupants
	Transportation	
	Unsuitability Criteria	

TABLE A-3-2

RANKING OF COAL TRACTS IN THE SAN JUAN RIVER REGION
NEW MEXICO

Tract	Summary Ranking	Rationale
La Plata #1	Medium	High quantity and quality of surface mineable coal, production potential moderate, federal surface, transportation would probably be by truck, some impacts to air quality, wildlife (deer winter range) and archaeology, minimal impact to water resources, no surface occupants, general public attitude is good, and socioeconomic impacts are expected to be minimal.
La Plata #2	Medium	High quantity and quality of underground mineable coal, production potential moderate, federal surface, transportation would probably be by truck, some impacts to archaeology, no surface occupants, general public attitude is good, and socioeconomic impacts are expected to be minimal.
La Plata #3	Medium	Low confidence in the quantity and quality of the coal resource for surface mineable coal, poduction potential is low, transportation would probably be by truck, the surface is primarily federal, some impacts to archaeology, air quality, wildlife (deer winter range), minimal impact to water resources, no surface occupants, general public attitude is good, and socioeconomic impacts are expected to be minimal.
La Plata #4	Medium	Low confidence in the quantity and quality of the coal resource for underground mineable coal, production potential is low, tranportation would probably be by truck, surface is primarily private, some impacts to archaeology and a plant of high state interest, general public attitude is good, and socioeconomic impacts are expected to be minimal.
Johnson Trading Post	Medium	Moderate quantity and quality of surface mineable coal, production potential moderate, transportation to the proposed Star Lake railroad would be greater than five miles, surface ownership is primarily federal with some private ownership, major impacts to air quality and paleontology, some impacts to wildlife, archaeology, and historic resources, minimal impacts would occur to water, general public attitudes are favorable, a major impact on socioeconomics would likely occur, and families do occupy an area of this tract. Portions of this tract may need to be dropped in the areas of wildlife and occupant conflicts.

TABLE A-3-2 (cont'd)

Tract	Summary Ranking	Rationale
Star Lake East #1	Medium	High quantity and quality of surface mineable coal, production potential is moderate, transportation to the Proposed Star Lake railroad is greater than five miles, surface ownership is mixed but is primarily federal, major impacts to air quality and paleontology, some impacts to water resources, archaeology and historic resources, general public attitude is favorable, a major impact on socioeconomics is expected to occur, families do occupy this tract.
Star Lake East (LC)	Medium	Low confidence in the quantity and quality of the coal resource for underground mineable coal, production potential is moderate, transporation to the proposed Star Lake railroad is greater than five miles, surface ownership is primarily federal, some impacts are expected to occur to air quality, water resources and archaeology, general public attitude is favorable, impacts to socioeconomic resources are expected to occur, relocation of occupants will be minimal.
Star Lake West #2	Medium	High quantity and quality of surface mineable coal, production potential is moderate, transportation to the proposed Star Lake railroad is less than five miles, surface ownership is mixed federal and state, major impacts are expected to occur to air quality and paleontology, some impact to water resources, archaeology, historic and the Continental Divide Trail, general public attitude is favorable, and impacts to socioeconomics expected to be moderate.
Kimbeto #1	Medium	High quantity and quality of underground mineable coal, production potential moderate, transportation to the proposed Star Lake railroad is less than five miles, surface ownership is mixed federal and private with surface ownership primarily federal, some impacts would occur to archaeology and water quality, general public attitude is favorable, impacts to socioeconomics are expected, and families do occupy portions of this tract.

TABLE A-3-2 (cont'd)

Tract	Summary Ranking	Rationale
Kimbeto #2	Medium	High quantity and quality of surface mineable coal, production potential is moderate, transportation to the proposed Star Lake railroad is less than five miles, surface ownership is federal, major impacts are expected to occur to air quality and paleontology, some impacts would occur to water resources, and archaeology, general public attitude is favorable, social economic impacts are expected to be minimal.
Nageezi	Medium	High quantity and quality of underground mineable coal, production potential is moderate, transportation to the proposed Star Lake railroad is greater than five miles, surface ownership is mixed but primarily federal, some impacts would occur to water resources and archaeology, general public attitude is favorable, some impacts to socioeconomics are expected, families do occupy areas of this tract.
Gallo Wash #1	Medium	High quantity and quality of surface mineable coal, production potential is favorable, transportation to the proposed Star Lake railroad is less than five miles, surface is primarily private with some federal ownership, major impacts are expected to occur to air quality and paleontology, some impacts would occur to water resources and archaeology, general public attitude is moderate, and socioeconomic impacts are expected to be moderate.
Gallo Wash #2	Medium	Moderate quantity and quality of underground mineable coal, production potential is moderate, transportation to the proposed Star Lake railroad is greater than five miles, surface ownership is mixed with primary ownership being state, some impacts would occur to water resources and archaeology, general public attitude is favorable, socioeconomic impacts are expected to be minimal, occupants do occur on areas of this tract.

TABLE A-3-2 (cont'd)

Tract	Summary Ranking	Rationale
Bisti #1	Medium	High quantity and quality of surface mineable coal, production potential is moderate, transportation to the proposed Star Lake railroad is less than five miles, surface ownership is mixed, but is primarily federal, major impacts to air quality and paleontology would occur, some impacts to water resources, archaeology and recreation resources in the Bisti Badlands, general public attitude and economics are favorable, known Navajo sacred and historic areas, no occupants.
Bisti #2	Medium	High quantity and quality of surface mineable coal, production potential is moderate, transportation to the potential Star Lake railroad is less than five miles, surface ownership is mixed and is primarily private, major impacts to paleontology, some impacts to air quality, water resources, archaeology, and recreation are expected to occur, general public attitude and economics are favorable, social impacts are moderate. Occupants do occur on areas of this tract.
Bisti #4	Medium	High quantity and quality of surface mineable coal, production potential moderate, transportation to the proposed Star Lake railroad is less than five miles, surface ownership is mixed with private land and federal land being nearly equal, major impacts to paleontology and wildlife area for the ferruginous hawk (acreage for these high federal interest species would need to be dropped out), impacts would occur to air quality, water resources and archaeology, general public attitude is favorable, socioeconomic impacts are expected to be minimal, known Navajo gathering areas occur on the tracts, no occupants.

TABLE A-3-2 (cont'd)

Tract	Summary Ranking	Rationale
Bisti #6	Medium	High quantity and quality of surface mineable coal, production potential moderate, transportation to the proposed Star Lake railroad is less than five miles, surface ownership mixed with primairly private lands under Navajo ownership, major impacts to paleontology and unique scenic resources of the Bisti Badlands, some impacts to air quality and archaeology, general public attitude is unfavorable, social impacts to the Navajo is considerable, known burial sites occur on tract, economic impacts are minimal, occupants do occur on areas of this tract.
Lee Ranch East	High	High quantity and quality of surface mineable coal, production potential high, transportation to the proposed Star Lake railroad is greater than fifteen miles, private surface, some impacts to air quality, water resources and archaeology, general public attitude is good, socioeconomic impacts are expected to be minimal, no occupants.
Lee Ranch Middle	Medium	High quantity and quality of surface mineable coal, production potential moderate, transportation to the proposed Star Lake railroad is less than fifteen miles, private surface, major impacts to air quality and water resources, some impacts to wildlife and archaeology are expected, general public attitude is good, some impacts on socioeconomics are expected, no occupants.
Lee Ranch West	High	High quantity and quality of surface mineable coal, production potential high, transporation to the proposed Star Lake railroad is less than fifteen miles, private ownership, major impacts to air quality, some impacts to water resources and archaeology, general public attitude is good, some impacts on socioeconomics are expected, no occupants.

TABLE A-3-2 (cont'd)

Tract	Summary Ranking	Rationale
Divide	High	High quantity and quality of surface mineable coal, production potential high, proposed Star Lake railroad traverses the tract, surface ownership is primarily private, consent has been given, some impacts to air and water resources, general public attitude is good, some impacts for socioeconomics are expected, occupants occur in the southwest portion of the tract.
Crownpoint Northeast	Medium	Moderate confidence in the quantity and quality of surface mineable coal, production potential is low, transportation to the proposed Star Lake railroad is greater than fifteen miles, primarily Navajo owned surface, major impacts to air quality, some impacts to archaeology and State listed high interest plant species, general public attitude is unfavorable, major impacts on socioeconomics, and thirty seven (37) occupied homes occur on the tract.
Crownpoint East	Medium	Moderate confidence in the quantity and quality of surface mineable coal, production potential is moderate, transportation to the proposed Star Lake railroad is less than fifteen miles, primarily Navajo surface, some impacts to air, water, and archaeology resources, general public attitude is favorable, major impacts on socioeconomics and twenty five (25) occupied homes occur on the tract.
Hospah #1	High	High quantity and quality of surface mineable coal, production potential is high, proposed Star Lake railroad passes through tract, no federal surface, major impacts to air quality, some impacts to water resources, wildlife, archaeology, and the CDNST, general public attitude is good, little impact to socioeconomics is expected, no occupants.
Hospah #2	High	High quantity and quality of underground mineable coal production potential is high, proposed Star Lake railroad passes within one mile of tract, no federal surface, some impacts to CDNST, general public attitude is good, socioeconomic impacts are expected to be minimal, no occupants.

TABLE A-3-2 (cont'd)

Tract	Summary Ranking	Rationale
Chico Wash South	Medium	Moderate confidence in the quantity and quality of surface mineable coal, production potential is low, transportation to the proposed Star Lake railroad is greater than fifteen miles, primarily federal surface, major impacts to air quality, water resources, and wilderness, some impacts to archaeology and historic resources (Azabache Stage Station located in tract boundaries), public has expressed concern due to close proximity to WSA, socioeconomic impacts are expected to be significant, no occupants.
Catalpa Canyon	Medium	High quantity and quality of surface mineable coal, production potential is moderate, transportation to the AT and SF railroad is less than five miles, all private surface, some impacts to air quality, and state high interest plant species, general public attitude is favorable, socioeconomic impacts are expected to be minimal, no occupants.
Sundance	Medium	High quantity and quality of surface mineable coal production potential is moderate, transportation is less than five miles to AT and SF railroad, Navajo surface, major impacts to archaeology, some impacts to air quality, general public attitude is favorable, major impacts to social well being and minimal impact to economics, seven (7)occupied homes on the tract.
Tah-ha-bah Well	Low	Low confidence in the coal, natural environment and socioeconomic data available for this tract, however, small business has expressed interest in this tract, twenty one (21) occupied homes.
Hogback	Low	Low confidence in the coal, natural environment and socioeconomic data thats available for this tract, however small business has expressed interest in this tract, state listed high interest species, adjacent to high school, seventeen (17) occupied homes and a fully occupied trailer court occurs on this tract.

TABLE A-3-2 (cont'd)

Tract	Summary Ranking	Rationale
Twin Buttes	Low	Low confidence in the coal, natural environment, and socioeconomic data available for this tract, however small business has expressed interest in this tract, ninty three (93) occupied homes occur on this tract.
Pinehaven	Medium	Low confidence in the coal, natural environment and socioeconomic data available for this tract, small business has expressed interest and would acquire more coal data and work with surface ownership to acquire consent, no federal ownership, transportation to the AT and SF railroad is less than fifteen miles, some impacts to archaeology, water and air quality, one hundred and seven (107) occupied homes occur on the tract, general public attitude is unfavorable.
Bread Springs #1	Medium	Low confidence in the coal, natural environment, and socioeconomic data that's available for this tract, small business has expressed interest in obtaining additional coal data and will try to get surface owner consent, no federal surface, some impacts to air quality, general public attitude is unfavorable, socioeconomic impacts would be singificant, seventeen (17) occupied homes occur on the tract.
Bread Springs #2	Low	Low confidence in the coal, natural environment, and socioeconomic data that is available for this tract, small business has expressed interest in obtaining this tract and in gathering additional coal data, no federal surface, general public attitude is unfavorable, socioeconomic impacts are expected to be minimal, no surface occupants.
Gamerco #1 (HC)	Medium	High quantity and quality of surface mineable coal, production potential moderate, transportation to the AT and SF railroad is less than five miles, no federal surface, some impacts to air quality, general public attitude is favorable, socioeconomic impacts are expected to be moderate, two (2) occupied homes occur on the tract.

TABLE A-3-2 (Concluded)

Tract	Summary Ranking	Rationale
Gamerco #1 (LC)	Medium	Low confidence in the quantity and quality of the surface mineable coal, moderate production potential due to the close proximity of Carbon Coal's existing mine and transportation is in place, no federal surface, some impacts to air quality, general public attitude is unfavorable, socioeconomic impacts are expecued to be moderate, two (2) occupied homes occur on the tract.
Gamerco (UG) (LC)	Medium	Low confidence in the quantity and quality of the underground mineable coal, moderate production potential due to the close proximity to Carbon Coal's existing mine and transporation is in place, no federal surface, general public attitude is unfavorable, socioeconomic impacts are expected to be significant, thirty five (35) occupied homes occur on this tract.
Samson Lake #1	Medium	Low confidence in the quantity and quality of the underground mineable coal, moderate production potential due to the close proximity to Carbon Coal's existing mine and transportation is in place, primarily private surface, some impacts to water resources, general public attitude is favorable, socioeconomic impacts are expected to be moderate, thirty three (33) occupied homes occur on this tract.
Samson Lake #2	Medium	Moderate confidence in the quantity and quality of the surface mineable coal, production potential is moderate, due to the close proximity of Carbon Coal's existing mine and transportation is in place, some impacts to air quality, general public attitude is favorable, socioeconomic impacts are expected to be minimal, fifteen (15) occupied homes occur on this tract.

APPENDIX A-4

FEDERAL LAWS AND REGULATIONS AFFECTING COAL DEVELOPMENT

Resource	Popular Name	Law/Regulation/ U.S. Code Citation	Purpose/Major Relevance
	National Environmental Policy Act of 1969	91-190; 42 U.S.C. 4321	Makes environmental protection part of the mandate of every federal agency. Requires impact statement for major federal actions with potentially significant impacts.
			Provides legislative authority to control energy development on environmental grounds. Impact statement proces must be integral part of coal leasing system.
Air Quality	Clean Air Act Amendments of 1977	95-95; 42 U.S.C. 7401	Establishes requirements for areas failing to attain National Ambient Air Quality Standards (NAAQS). Provides for prevention of significance deterioration of areas where air is cleaner than NAAQS. May require a federal permit where conflicts with coal development exist. Modifies 1970 air act provisions regarding federal facilities, enforcement strategies, coal utilization impacts, and inter-state air pollution.
			May make certain coal lands off-limits for development. Limits industrial developments within and adjacent to areas exceeding NAAQS and areas preserving clean air quality. Reduces commercial attractiveness of low-sulfur Western coal as the new source standard changed to percent emissions reduction.
		30 CFR 817.95 (OSM)	Requires underground operator to employ fugitive dust control measures.
		30 CFR 784.26 (OSM)	Requires operator to establish monitoring systems for evaluation of dust control programs.
Topography, Geology and Soils		43 CFR 3465 (BLM)	Operators will use mining methods to prevent or control surface subsidence to maintain value and use of surface lands. Disturbed areas will be contoured and regulated after exploration.
		30 CFR, Part 816	Permanent Program Performance Standards -- Surface Mining Activities.
		30 CFR, Sections 816.21 through 816.25	Topsoil removal, storage, redistribution, and soil amendements.

APPENDIX A-4

FEDERAL LAWS AND REGULATIONS AFFECTING COAL DEVELOPMENT (CONTINUED)

Resource	Popular Name	Regulation/Law/ U.S. Code Citation	Purpose/Major Relevance
Topography, Geology and Soils (Continued)		30 CFR, Section 816.41 through 816.57	Hydrologic balance, sediment control, impoundments, acid spoils and stream buffer zones.
		30 CFR, Sections 816.71 through 816.74	Disposal of excess spoil material.
		30 CFR, Sections 816.101 through 816.106	Backfilling, grading, and rill stablization.
		30 CFR, Sections 816.111 through 816.117	Revegetation.
		Department of Interior Policy	The Minerals Management Service will determine priority of development between coal, oil, and gas. Future uranium mineral claimants will coordinate with coal lessee. Unresolved conflicts will be settled in court.
Mineral Resources	Mining and Minerals Policy Act of 1970	91-631; 43 U.S.C. 21	Declares Congressional Mineral Policy.
			Provides broad, general principles for mineral resource development.
	Noise Control Act of 1972	92-574; 42 U.S.C. 4901	Requires publication of information on limits of noise required to protect pubic health and welfare. Preempts local control of railroad equipment and yard noise emissions.
			Regulations may be proposed to control coal mining areas and activities.
	Resources Conservation and Recovery Act of 1976	94-580; 42 U.S.C. 6901	Establishes guidelines for collection, transport, separation, recovery, and disposal of solid waste. Creates major federal hazardous waste regulatory program. Provides assistance to establish state or regional solid waste plans.
			Mining locations may be affected by EPA regulations governing disposal of coal mining wastes. Coal industry faced with stringent permit requirements if coal wastes classified by EPA as hazardous.

APPENDIX A-4

FEDERAL LAWS AND REGULATIONS AFFECTING COAL DEVELOPMENT (CONTINUED)

Resource	Popular Name	Regulation/Law/ U.S. Code Citation	Purpose/Major Relevance
Paleontology		16 U.S.C. 431-433	Collection of vertebrate fossils prohibited.
	Federal Land Policy and Management Act Section 102 (a) (8)	43 U.S.C. 1701 (a) (8)	It is BLM policy to determine mitigation or protection stipulations for paleontology on a case-by-case basis. Clearances will be required for all surface-disturbing activities on coal tracts to avoid unnecessary destruction or disruption of fossils and collecting sites. Important sites will be salvaged.
	Antiquities Act of 1906	59-209; 16 U.S.C. 431	Regulates antiquities excavation and collection (including fossil remains). Protects historical values on public land. Mitigates potential harm to historical, archaeological, and paleontological resources.
	Archaeological and Historical Preservation Act of 1974; Archaeological Salvage Act	93-291, 86-523; 16 U.S.C. 469	Provides for recovery of data from areas to be affected by federal actions. Provides for preservation of data (including relics and specimens) at every federal construction project. Mitigates potential harm to historical, archaeological, and paleontological resources. Mitigates potential harm to historical and archaeological resources.
Water Resources	Clean Water Act of 1977	95-217; 33 U.S.C. 1251	Establishes effluent limitations for new and existing industrial discharges into U.S. waters. Limitations set for public treatment discharges; with pretreatment by industrial users. Provides mechanism to restore and maintain integrity of the nation's waters. May reduce development options in areas where antidegradation policy restricts discharges into high quality waters. Treatment facilities in areas with rapidly expanding infrastructures must meet water quality standards. Effluent standards apply to coal mining point sources.

APPENDIX A-4

FEDERAL LAWS AND REGULATIONS AFFECTING COAL DEVELOPMENT (CONTINUED)

Resource	Popular Name	Regulation/Law/ U.S. Code Citation	Purpose/Major Relevance
Water Resources (Continued)	Safe Drinking Water Act of 1977	95-190; 42 U.S.C. 300	Establishes mechanism for National Primary Drinking Water Standards.
			EPA conducting study of the impacts of pits, ponds, lagoons, etc. on underground water supplies for public water systems.
		30 CFR 817.42 (OSM)	Restricts pollutant discharge.
		30 CFR 817.45 150-176 (OSM)	Amount of sediment produced will be minimized by conformance.
		30 CFR 817.54 (OSM)	Disrupted water supplies will be replaced.
		30 CFR 817.121 (OSM)	Mining will be conducted to minimize surface damage.
	Federal Water Pollution Control Act of 1972, as amended	33 U.S.C. 1251 et. seq.	Establishes water quality standards adopted by N.M. Water Quality Control Commission and approved by Environmental Protection Agency.
Vegetation	Surface Mining Control and Reclamation Act of 1977	U.S.C. 1265 (b) (19)	Diverse and permanent vegetative cover capable of self-regeneration at least equal in extent to natural vegetation will be established on affected areas.
	Soil and Water Resources Conservation Act of 1977	95-192; 16 U.S.C. 2001	Requires appraisal by Secretary of Agriculture of information and expertise on conservation and use of soils, plants, woodlands, etc.
			Provides opportunity for expanded data base.
		30 CFR 817.13 (OSM)	Exposed underground openings will be managed to ensure safety of people and livestock.
		30 CFR 817.54 (OSM)	Disrupted water supplies will be replaced.

FEDERAL LAWS AND REGULATIONS AFFECTING COAL DEVELOPMENT (CONTINUED)

Resource	Popular Name	Regulation/Law/ U.S. Code Citation	Purpose/Major Relevance
Wildlife	Bald Eagle Protection Act of 1969, as amended	86-70; 16 U.S.C. 668	Protects bald and golden eagles. May make certain coal lands off-limits for development.
	Endangered Species Act of 1973; as amended	93-205; 16 U.S.C. 1531	Protects endangered and threatened species and critical habitat form federal activities. Requires prior consultation with Fish and Wildlife Service. May make certain coal lands unsuitable for development.
	Fish and Wildlife Coordinations Act of 1934.	85-624; 16 U.S.C. 661	Required consultation about water resource development actions which might affect fish or associated wildlife resource. Mitigates potential federal coal development impacts.
		30 CFR 817 (OSM)	Requires restoration of soils and vegetation allows wildlife to repopulate area upon completion of mining and removal of surface facilities.
Cultural Resources	Historic Preservation Act of 1966	89-665; 16 U.S.C. 470 See also 94-429; 16 U.S.C. 1609	Establishes system of classifying properties on or eligible for inclusion on Historic Register. Mandates federal agency consultation with Advisory Council and State historic preservation officers.
			MItigate potential harm to historical and archaeological values.
	Antiquities Act of 1906		Refer to Paleontology
	Archaeological and Historical Preservation Act of 1974;		Refer to Paleontology
		16 U.S.C. 469	A lessee will be required to carry out intensive field inventories of cultural resources on uninventoried portions of the areas that may be affected by lease-related activities, and develop mitigation plans that include, as appropriate, pro-

APPENDIX A-4

FEDERAL LAWS AND REGULATIONS AFFECTING COAL DEVELOPMENT (CONCLUDED)

Resource	Popular Name	Regulation/Law/ U.S. Code Citation	Purpose/Major Relevance
Cultural Resources (Continued)			visions for data recovery, curation, detailed recordation, stabilization, and relocation to provide appropriate levels of protection from adverse effects for specific properties.
Visual Resource Management		30 CFR 717.14 (a) (OSM)	Disturbed work areas will be regraded to approximate original contour upon completion of Mining.
		30 CFR 817.111-117 (OSM)	Revegetation requirements.
Wilderness	Federal Land Policy and Management Act	43 U.S.C. 1782	Access across pubic lands under review for wilderness is granted by the Secretary only when it would not impair suitability of the area for that designation.
Land Uses		43 U.S.C. 1712	Valid existing rights will be identified and protected in BLM Land-Use Plans.
Transportation		30 CFR 817.124 (OSM)	Rights-of-Way will be protected.
Social and Economic Factors	Mineral Leasing Act of 1920, as amended	30 U.S.C. 191	Fifty percent of royalities from Federal coal will be returned to the State.
American Indian Concerns	American Indian Religious Freedom Act	Public Law No. 95-341	Requires consideration of Indian religious practices.

APPENDIX A-5

STATE LEGISLATION AND REGULATIONS AFFECTING COAL DEVELOPMENT

Legislation	Purpose/Relevance
New Mexico Air Quality Control Regulation 201	Specifies standards not to be equalled or exceeded.
New Mexico Air Quality Standards and Regulation, Section 672	Coal handling equipment will be equipped to prevent particulate matter from becoming airborne. Haul roads will be sprayed to prevent particulate matter from becoming airborne.
State of New Mexico Senate Memorial 31	Mining operators on state lands will notify the State of New Mexico, Dept. of Finance and Administration, Office of Cultural Affairs, if important fossils are found.
N.M. Stat. Annot. (1953 Compil.), Section 75-21	As a means of conservation, the State Engineer of New Mexico supervises, measures, appropriate and distributes state waters.
New Mexico Surface Mining Act of 1979; New Mexico Coal Surface Mining Commission, Rule 78-1, Section 37;	Full range of coal mining protection including, diverse and permanent vegetative cover capable of self-regeneration at least equal in extent to natural vegetation will be established on affected areas.
Rule 80-1, Section 20-41 et seq.	Surface coal mining operations will be planned and conducted to minimize adverse changes in water quality and quantity.
N.M. Regulation 563, as amended	The New Mexico State Department of Game and Fish is responsible for state endangered species and subspecies.
New Mexico Severance Tax Act	Tax of $.38/ton will be paid on steam coal.

IN REPLY REFER TO

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
NEW MEXICO STATE OFFICE
P.O. BOX 1449
SANTA FE, NEW MEXICO 87501

CERTIFIED--RETURN RECEIPT REQUESTED

	Decision	
Permittee	:	Coal Preference Right
(INSERT NAME AND ADDRESS	:	Lease Application
of COMPANY)	:	NM (INSERT NUMBER)
	:	

Request for Final Showing - Information Required

You are hereby allowed 90 days from receipt of this request for final showing to submit the information required under 43 CFR 3430.4-1(c) and (d) for the above-captioned coal preference right lease application (PRLA).

As required by 43 CFR 3430.3, an environmental assessment and Management Framework Plan (i.e. land use plan) have been completed covering the lease application area. Copies of the draft and final environmental assessment and Management Framework Plan Summary are being transmitted to you under separate cover. The following summarizes the results of the application of each of the unsuitability criteria and of land use planning to the lease application area. It also summarizes the basis for the stipulations set forth in Section 31 of the proposed coal lease form which is enclosed for the above-captioned PRLA.

Criterion Number 1

None of the lease application area was affected by this Criterion.

OR

Portions of the Continental Divide National Scenic Trail study corridor traverse the lease application area. The actual treadway for the Continental Divide National Scenic Trail has not been established. In view of this situation, the Criterion does not require the proposed study corridor to be designated as unsuitable for surface coal mining.

Criterion Number 2

None of the lease application area was affected by this Criterion.

OR

The lease application area contains the following rights-of-way: (INSERT LIST). The attached map shows the location of these rights-of-way. As allowed by paragraph (v) of the exceptions to Criterion Number 2, lands within these rights-of-way are suitable for coal mining operations. Excluding the lands would disrupt the logical mining of the coal in the lease application area and the uses authorized by these rights-of-way can be protected through the following stipulations.

These rights-of-way shall be relocated when needed to allow coal mining operations. For those right-of-way grants which contain terms or conditions allowing the right-of-way to be modified, the right-of-way grantee(s) shall pay all reasonable costs associated with the relocation. For other right-of-way grants, the coal lessee shall pay all reasonable costs associated with the relocation.

OR

The lease application area contains part of the approved right-of-way for the planned rail line of the Star Lake Railroad Company. The attached map shows the location of this right-of-way. The Star Lake Railroad right-of-way was granted for the purpose of transporting coal. Lands within the right-of-way are unsuitable for surface coal mining operations unless the lessee receives written permission from the right-of-way grantee and concurrence from the BLM allowing surface coal mining.

Criterion Number 3

None of the lease application area was affected by this Criterion. The lessee shall conduct a detailed survey for gravesites on areas that will be disturbed by surface coal mining. The BLM shall approve the survey. The survey shall be completed before the lessee applies for a permit under the Surface Mining Control and Reclamation Act. An area 100 feet surrounding each gravesite which may be disclosed by the survey shall be considered unsuitable for surface coal mining unless the lessee lawfully relocates the gravesite(s).

OR

Dwellings:

Authorized Occupied Dwellings:

The lease application area contains the following authorized occupied dwellings:

(INSERT LIST) (INSERT LAND DESCRIPTION)

The attached map shows the location of these authorized occupied dwellings. An area within 300 feet of each of these dwellings is unsuitable for surface coal mining operations unless the lessee receives written permission from the owner allowing surface coal mining operations.

OR

Unauthorized Occupied Dwellings:

The lease application area contains the following unauthorized occupied dwellings:

(INSERT LIST) (INSERT LAND DESCRIPTION)

The attached map shows the location of these unauthorized occupied dwellings. Not allowing surface coal mining of the land affected by these unauthorized occupancies would disrupt the logical mining of the coal in the lease application area. As allowed by the exception to the Criterion, the BLM gives written permission for surface coal mining of these lands under the following conditions.

Unless otherwise agreed to by the residents, the lessee will relocate the residents in accordance with the following stipulations:

1. Residents and grazing areas shall be relocated within the individual Navajos' current Navajo Chapter.

2. Relocation details shall be worked out with the resident.

3. Relocations shall be staggered so that they do not all occur at the same time.

4. Families shall be relocated as a unit and not be split up.

5. The new location should have sufficient water and forage to accommodate displaced flocks or herds.

Gravesites:

A gravesite(s) has been located on the lease application area in (INSERT LAND DESCRIPTION) as shown on the attached map. Unless the lessee lawfully relocates the gravesites(s), an area 100 feet surrounding the gravesite(s) is unsuitable for surface coal mining. The lessee shall conduct a detailed survey for gravesites on areas that will be disturbed by surface coal mining. The BLM shall approve the survey. The survey shall be completed before the lessee applies for a permit under the Surface Mining Control and Reclamation Act. All gravesites which may be disclosed by the survey shall also be considered unsuitable for surface coal mining unless the gravesite(s) is lawfully relocated. The lessee should contact the BLM Albuquerque District in order to determine the exact location of the known gravesite(s) described above.

OR

The lease application area is not presently known to contain gravesite(s). The lessee shall conduct a detailed survey for gravesites on areas that will be disturbed by surface coal mining. The BLM shall approve the survey. The survey shall be completed before the lessee applies for a permit under the Surface Mining Control and Reclamation Act. An area 100 feet surrounding each gravesite which may be disclosed by the survey shall be considered unsuitable for surface coal mining unless the lessee

lawfully relocates the gravesite(s).

Public buildings, schools, churches, community or institutional buildings or public park:

No public buildings, schools, churches, community or institutional buildings or public parks are located on the lease application area.

Roads:

The lease application area contains no authorized roads.

OR

The lease application area contains the following public road(s): (INSERT LIST). The attached map shows the location of the road(s). The area within 100 feet of the road(s) is unsuitable for surface coal mining unless the road(s) is relocated as allowed by the Surface Mining Control and Reclamation Act.

Criterion Number 4

None of the lands in the lease application area are in a Wilderness Study Area.

OR

As shown on the attached map, portions of the lease application area are within a Wilderness Study Area and are unsuitable for surface coal mining operations while the Wilderness Study Area is under review by the Administration and the Congress. The affected portions of the lease application area are subject to conditions or restrictions which the Congress may impose.

Criterion Number 5

None of the lease application area was affected by this Criterion.

Criterion Number 6

None of the lands in the lease application area are being used for scientific studies on discrete sites involving food or fiber production, natural resources or technology demonstrations under permit by the surface management agency as discussed in BLM Washington Office Instruction Memorandum 81-340. Therefore, none of the lease application area was affected by this Criterion.

Criterion Number 7

The lease application area is not presently known to contain districts,

sites, buildings, structures, and objects of historic, architectural, archeological, or cultural significance on Federal lands which are included in or eligible for inclusion in the National Register of Historic Places. Therefore, none of the lease application area was affected by this Criterion.

Section 31(a) of the proposed coal lease form is interpreted to include in situ preservation of sites which may be discovered during future inventories, provided that such sites are eligible for inclusion in the National Register of Historic Places and adequate mitigating measures cannot be devised. These determinations, if necessary, shall be made by the appropriate official in the Office of Surface Mining after consultation with the State Historic Preservation Officer, Minerals Management Service and the BLM.

OR

The lease application area contains the following districts, sites, buildings, structures or objects of historic, architectural, archeological, or cultural significance on Federal lands which are included in or eligible for inclusion in the National Register of Historic Places: (INSERT LIST). The attached map shows the location of these occurences.

IF THE LANGUAGE IMMEDIATELY ABOVE IS USED, IT WILL BE FOLLOWED BY EITHER A OR B BELOW. SOME PRLA's MAY INCLUDE BOTH A AND B.

A. The following sites are unsuitable for surface coal mining because mitigation cannot avoid significant adverse impacts to the property. This determination has been made by the BLM in consultation with the State Historic Preservation Officer (INSERT LIST). The attached map shows the location of these sites.

B. As allowed by the exception to the Criterion and after consultation between the BLM and the State Historic Preservation Officer, surface coal mining operations of the following sites will be allowed after the lessee carries out measures necessary to avoid significant adverse affects to the property in accordance with the plan approved by the authorized officer of the BLM (INSERT LIST). The attached map shows the location of these sites.

Section 31(a) of the proposed coal lease form is interpreted to include in situ preservation of sites which may be discovered during future inventories, provided that such sites are eligible for inclusion in the National Register of Historic Places and adequate mitigating measures cannot be devised. These determinations, if necessary, shall be made by the appropriate official in the Office of Surface Mining after consultation with the State Historic Preservation Officer, Minerals Management Service and the BLM.

Criterion Number 8

None of the lease application area was affected by this Criterion.

Criterion Number 9

None of the lease application area was affected by this Criterion.

Criterion Number 10

None of the lease application area was affected by this Criterion.

Criterion Number 11

None of the lease application area was affected by this Criterion.

OR

The lease application area contains an active golden eagle nest in (INSERT LAND DESCRIPTION). The nest and a buffer zone of (INSERT NUMBER) feet as shown on the attached map are unsuitable for surface coal mining operations unless the surface management agency and the Fish and Wildlife Service concur that surface coal mining will not disturb the eagles during the breeding season or unless the surface management agency with the concurrence from the Fish and Wildlife Service determines that the nest will be moved.

Criterion Number 12

None of the application area was affected by this Criterion.

Criterion Number 13

None of the lease application area was affected by this Criterion.

OR

The lease application area contains an active prairie falcon nest and a buffer zone in (INSERT LAND DESCRIPTION) as shown on the attached map. This area is unsuitable for surface coal mining operations unless the BLM and the Fish and Wildlife Service concur that surface mining will not disturb the falcons during the breeding season.

Criterion Number 14

None of the lease application area was affected by this Criterion.

OR

The lease application area contains high priority habitat for migrating birds of high Federal interest (Ferruginous hawk nest sites and buffer zones) in (INSERT LAND DESCRIPTION) as shown on the attached map. This

area is unsuitable for surface coal mining operations unless the BLM and the Fish and Wildlife Service concur that surface coal mining will not disturb the birds during the breeding season.

Criterion Number 15

The BLM has determined in consultation with the New Mexico Department of Game and Fish that none of the lease application area was affected by this Criterion.

Criterion Number 16

None of the lease application area was affected by this Criterion.

OR

The lease application area contains areas within the 100-year recurrence interval floodplains as shown on Federal Insurance Administration flood maps on file at (INSERT LOCATION). After consultation with the Minerals Management Service, the surface management agency has determined that with appropriate stipulations surface coal mining can be undertaken without substantial threat of loss to people or property. The surface management agency in consultation with the Minerals Management Service shall review the mining plan to be submitted by the lessee and specify any specific measures needed to ensure that mining will not cause a substantial threat of loss to people or property.

Criterion Number 17

None of the lease application area was affected by this Criterion.

Criterion Number 18

None of the lease application area was affected by this Criterion.

Criterion Number 19

None of the lease application area was affected by this Criterion.

Criterion Number 20

None of the lease application area was affected by this Criterion.

In addition to the stipulations which resulted from application of the unsuitability criteria, the following stipulations are required to ensure that coal mining operations on the lease application area are consistent with the BLM Chaco/San Juan Management Framework Plan approved September 21, 1981. These are also set forth in Section 31 of the proposed coal lease form.

ONLY THOSE STIPULATIONS WHICH EITHER APPLY TO THE PARTICULAR PRLA BEING DISCUSSED OR TO ALL OF THE PRLA's WILL BE INCLUDED.

A. The lessee shall not conduct coal mining operations on (INSERT LAND DESCRIPTION) until the BLM has received from the lessee a completed study on the excavation and extraction of the paleontological resources found on these lands or until September 21, 1991, whichever comes first, as determined by the BLM's authorized officer. Exploration may be allowed during this period at the discretion of the Minerals Management Service with concurrence from the BLM.

B. The following portion of the lease application area overlaps the Navajo Indian Irrigation Project: (INSERT LAND DESCRIPTION). The lessee shall not conduct coal mining operations on this overlapping area until consultations between the lessee, NIIP, Minerals Management Service and BLM indicate that coal mining operations will not interfere with active intensive agriculture, as determined by the BLM's authorized officer.

C. The lessee shall protect the physical and legal availability of existing water sources in the lease application area. Any water removed or contaminated due to coal mining operations shall be replaced by the lessee. Although replacement water need not be identical to the original water source, it shall be of equal quality and quantity or better.

D. The lessee shall transfer any water wells drilled on BLM-administered surface in the lease application area to the surface management agency upon expiration, termination, cancellation or relinquishment of the lease.

E. The lessee shall return all lands affected by coal mining operations to the Visual Resource Management class or better which existed prior to mining. Surface structures associated with coal mining operations shall be painted a color that is similar to colors commonly found in the surrounding landscape, except where other colors are needed to meet safety requirements.

F. Coal mining operations in the lease application area on lands within Known Geologic Structures of producing oil and gas fields shall not interfere with the economic recovery of oil and gas, except as determined by the Minerals Management Service.

G. The lessee shall conduct coal mining operations on (INSERT LAND DESCRIPTION) in a manner which minimizes adverse impacts to the recreational,

scenic and scientific values recognized in the proposed Bisti/Denazin Area of Critical Environmental Concern, as determined by the authorized officer of the BLM after consultation with the Minerals Management Service.

H. The following portion of the lease application area contains a Native American sacred site or area: (INSERT LAND DESCRIPTION.) The lessee shall not conduct coal mining operations within this area which would impair the integrity of the Native American sacred site or area, as determined by the authorized officer of the BLM after consultation with the Minerals Management Service. The lessee should contact the BLM Albuquerque District to determine the exact location of the Native American sacred site or area.

If you have questions regarding the above summary of the results of the application of the unsuitability criteria and of land use planning or the stipulations set forth in Section 31 of the proposed coal lease form, please contact Mary Zuschlag, Environmental Coordinator, BLM Albuquerque District Office, P. O. Box 6770, Albuquerque, New Mexico 87107; Telephone: (505)766-2455.

The environmental effects of the above-captioned PRLA are being further addressed in the San Juan River Regional Coal Leasing Environmental Impact Statement (EIS). A final decision on the above-captioned PRLA is scheduled for June 1983, shortly after the EIS is final. As a result of our analysis of the EIS, we may require changes in the stipulations now proposed as well as additional stipulations. If we do make changes which could significantly affect your final showing, we will require you to resubmit your final showing. For this reason, we will not reach a final decision on your application until after the EIS is done.

If the final showing information required under 43 CFR 3430.4-1(c) and (d) is not submitted within the time allowed, the coal preference right lease application will be subject to rejection.

Please be aware that upon final lease issuance, the lease terms will conform to the regulations in force at that time.

Guidance in the preparation of the final showing can be obtained from Billie E. Clark, Jr., District Mining Supervisor, Minerals Management Service, P. O. Box 959, Farmington, New Mexico 87401; Telephone: (505)327-7317.

If assistance is needed on other matters concerning this request for final showing, please call Theresa Romero or myself. Our telephone number is (505)988-6306.

Thomas D. Golden
Chief, Mining Unit

APPENDIX A-7

BIRDS OF PREY HABITAT WITHIN THE PRLA AREA

BLM Nest Inventory Number	Species	Applicable Unsuitability Criteria Number	Acres Needed for Protection	PRLA No.	Type of Mine
4A-4B	Ferruginous Hawk	14	220	NM 3835	Surface
5	Ferruginous Hawk	14	640	NM 3919	Surface
6A-6B	Ferruginous Hawk	14	640	NM 3919	Surface
22, 24	Ferruginous Hawk	14	165	NM 11916	Underground
20	Prairie Falcon	13	---	NM 3834	Underground

APPENDIX A-8

BIRDS OF PREY HABITAT ON COAL TRACTS OUTSIDE THE PRLA AREA

BLM Nest Inventory Number	Species	Applicable Unsuitability Criteria Number	Acres Needed for Protection	Tract	Type of Mine
19	Ferruginous Hawk	14	115	Bisti #4	Surface
14	Golden Eagle	11	75	Johnson Trading Post	Surface

THE NAVAJO NATION
WINDOW ROCK, ARIZONA 86515

PETER MacDONALD
CHAIRMAN

The Honorable James G. Watt
Secretary of the Interior
Department of the Interior
C Street between 18th & 19th Streets, N.W.
Washington, D.C. 20240

Subject: Selection of Lands under
P.L. 93-531, as amended.

Dear Secretary Watt:

The Navajo Tribe, pursuant to authority contained in Section 11 of P.L. 93-531, as amended (25 USC Section 640d-10), in consultation with the Navajo and Hopi Indian Relocation Commission, hereby selects for transfer to the Navajo Tribe the lands under the jurisdiction of the Bureau of Land Management within the State of New Mexico as described in Attachment A. This selection includes all surface and subsurface rights to such lands subject only to valid existing rights as of the date of selection.

This selection is made subject to the condition that where any of such lands are subject to existing preferential coal lease applications wherein leases for the mining of coal have not yet been executed by the United States, in the event any such coal lease is executed by the United States and/or the Navajo Tribe after the date of this selection, the royalties and other benefits under such coal lease shall inure the benefit of the Navajo Tribe to be used solely for the benefit of Navajo families residing on Hopi-partitioned lands as provided in the above Act. In the event that this condition cannot be honored as to all or any part of the lands selected we reserve the right to withdraw or amend the selection in whole or in part.

We request that all lands selected herein be withdrawn from disposition under the public land laws pending final disposition of this selection.

We further request that this selection be acted upon at the secretarial level in the first instance and that the Navajo Tribe and the Navajo and Hopi Indian Relocation Commission be given opportunity to participate in discussion of any problems which may be involved and in the resolution of such problems before any decision is made.

Sincerely,

Peter MacDonald, Chairman
Navajo Tribal Council

NAVAJO-HOPI INDIAN
RELOCATION COMMISSION:

Chairman

Commissioner

Commissioner

LEGAL DESCRIPTION OF THE NEW MEXICO BUREAU OF LAND MANAGEMENT LANDS LOCATED WITHIN THE PARAGON RANCH SELECTED BY THE NAVAJO TRIBE

		Acreage
Township 22 North, Range 10 West, NMPM		
Sec. 4	Lots 1,2,3,4; s½N½; 20 AC (±) within the NW Portion of the NW¼ SW¼	340.84
Sec. 5	All	640.90
Sec. 6	All	638.64
Sec. 7	19.75 AC (±) within the NW portion of Lot 1	19.75
Township 22 North, Range 11 West, NMPM		
Sec. 6	Lots 8 thru 15, Inclusive	334.12
Sec. 12	NW¼; N½ NE¼; SW¼ NE¼; 20 AC (±) within the NW portion of the SE¼ NE¼	300.00
Township 22 North, Range 12 West, NMPM		
Sec. 4	Lots 1,2; S½ NE¼; S½	479.28
Township 23 North, Range 10 West, NMPM		
Sec. 19	All	640.08
Sec. 20	All	640.00
Sec. 21	S½, 52 AC (±) within the NW¼	372.00
Sec. 28	N½, SW¼	480.00
Sec. 29	All	640.00
Sec. 30	All	640.72
Sec. 31	All	640.06
Sec. 33	All	640.06

Township 23 North, Range 11 West, NMPM		Acreage
Sec. 6	All	632.57
Sec. 7	Lots 1, 2; E½ NW¼; NE¼	316.76
Sec. 8	S½	320.00
Sec. 9	SE¼	160.00
Sec. 18	All	634.16
Sec. 19	Lots 1, 2, 3, 4; E½ W½; W½ E½	476.04
Sec. 20	E½ E½	160.00
Sec. 21	All	640.00
Sec. 22	S½, NW¼	480.00
Sec. 23	S½	320.00
Sec. 24	N½, SE¼	480.00
Sec. 25	NW¼, S½	480.00
Sec. 26	All	640.00
Sec. 27	All	640.00
Sec. 28	All	640.00
Sec. 33	All	640.00
Sec. 34	All	640.00
Sec. 35	All	640.00

Township 23 North, Range 12 West, NMPM		
Sec. 9	Lots 1, 2, 3, 4	170.32
Sec. 12	All	674.32
Sec. 13	All	666.65
Sec. 14	Lots 1 thru 8, Inclusive; NW¼	491.95
Sec. 17	Lots 1, 2, 7, 8, 9, 10, 12, 13	335.65

Township 23 North, Range 12 West, NMPM (Cont'd)		Acreage
Sec. 19	All	654.71
Sec. 20	All	662.30
Sec. 21	All	663.45
Sec. 22	All	661.31
Sec. 23	All	649.63
Sec. 24	All	650.20
Sec. 26	All	640.00
Sec. 28	All	640.00
Sec. 29	All	640.00
Sec. 30	All	635.32
Sec. 34	All	640.00

Township 24 North, Range 11 West, NMPM		
Sec. 31	Lots 3, 4; E½ SW¼	156.48

Township 24 North, Range 12 West, NMPM		
Sec. 25	All	687.48
Sec. 26	Lots 9 thru 16, Inclusive	343.33
Sec. 27	Lots 9 thru 16, Inclusive	342.98
Sec. 28	Lots 9 thru 16, Inclusive	343.10
Sec. 29	Lots 9 thru 16, Inclusive	341.10
Sec. 33	All	687.97
Sec. 34	All	684.11

Township 23 North, Range 11 West, NMPM		
Sec. 2	Lots 1, 2, 3, 4; S½ N½; S½	639.36
Sec. 3	Lots 1, 2, 3, 4; S½ N½; S½	638.58

Township 24 North, Range 11 West, NMPM		Acreage
Sec. 21	S½	320.00
Sec. 28	All	640.00
Sec. 33	N½	320.00
Sec. 34	All	640.00
Sec. 35	All	640.00
Township 23 North, Range 13 West, NMPM		
Sec. 14	S½ N½; S½	480.00
Sec. 23	All	640.00
Sec. 24	All	640.00
	TOTAL ACREAGE:	35,000.00

APPENDIX B
WATER RESOURCES

APPENDIX B-1

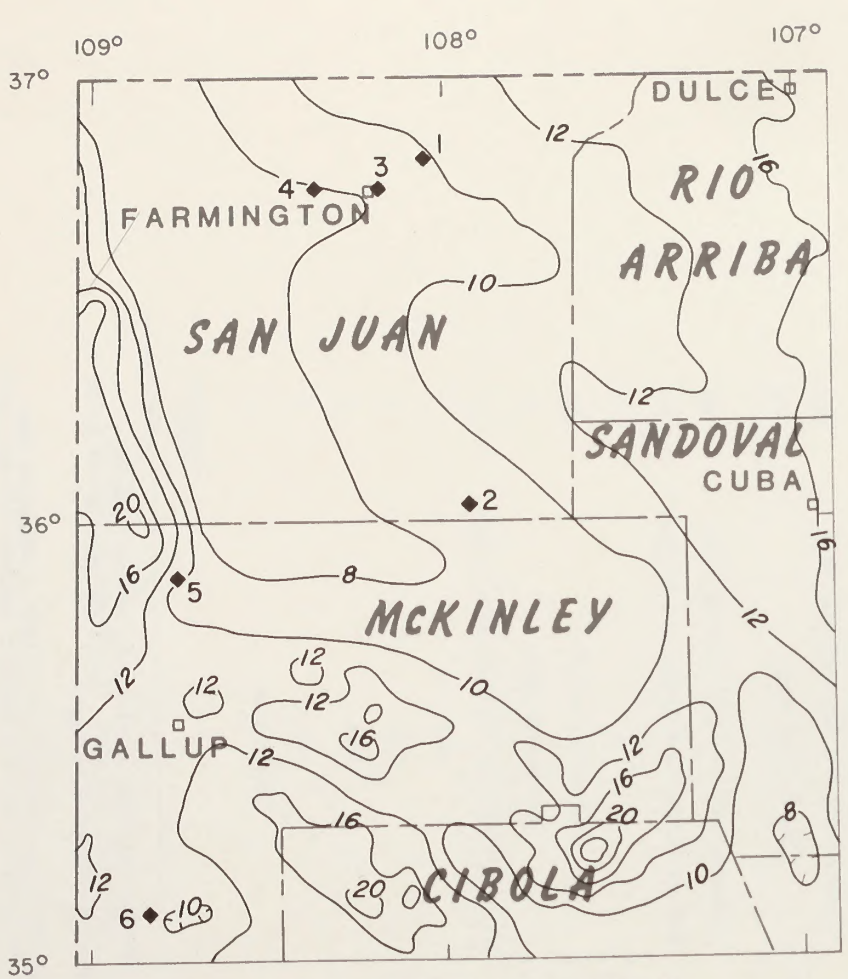
APPROXIMATE FLOODPLAIN ACREAGES
ON SURFACE MINEABLE COAL TRACTS[a/],[b/]

Coal Tract	Major Drainageway(s) (including tributaries)	Acreage
La Plata #1	N/A	0
La Plata #3	N/A	0
Johnson Trading Post	San Isidro Wash	190
Star Lake East #1	Salazar and Papers Washes,	75
Star Lake West #2	Arroyo Pueblo Alto	16
Kimbeto #2	Betonnie Tsosie Wash	180
Gallo Wash #1	N/A	0
Bisti #1	Alamo and De-na-zin Washes, and Coal Creek	460
Bisti #2	Hunter Wash	87
Bisti #4	N/A	0
Bisti #6 and #8	N/A	0
Lee Ranch East	N/A	0
Lee Ranch Middle	San Isidro, Doctor, and Tinaja Arroyos, Mulatto Canyon Creek, and Voght Draw	948
Lee Ranch West	Canyon Largo and Mulatto Canyon Creeks, and Arroyos Leon and Tinaja	412
Divide	Canada Marcelina and Milpitas Draw	513
Crownpoint Northeast	Indian Creek and Kim-me-ni-oli Wash	400
Crownpoint East (LC & HC)	Kim-me-ni-oli Wash	405
Hospah #1	Inditos Draw and Kim-me-ni-oli Wash	509
Chico Wash South	Arroyos Chico, La Azabache and Seccion	315
Catalpa Canyon	N/A	0
Pinehaven	White Water Arroyo	380
Twin Buttes	Twin Buttes Wash	36
Hogback	Catalpa Canyon and Peretti Canyon Creeks	37
Sundance	N/A	0
Bread Springs #1	N/A	0
Gamerco #1 (LC)	N/A	0
Gamerco #1 (HC)	N/A	0
Samson Lake #2 (LC & HC)	Samson Lake	15
TOTAL		4,978

Source: U.S. Dept. of Housing and Urban Development, Federal Insurance Administration, 1977, 1978, and 1980. (Acreages computed with dot grid, using Flood Hazard Boundary Maps).

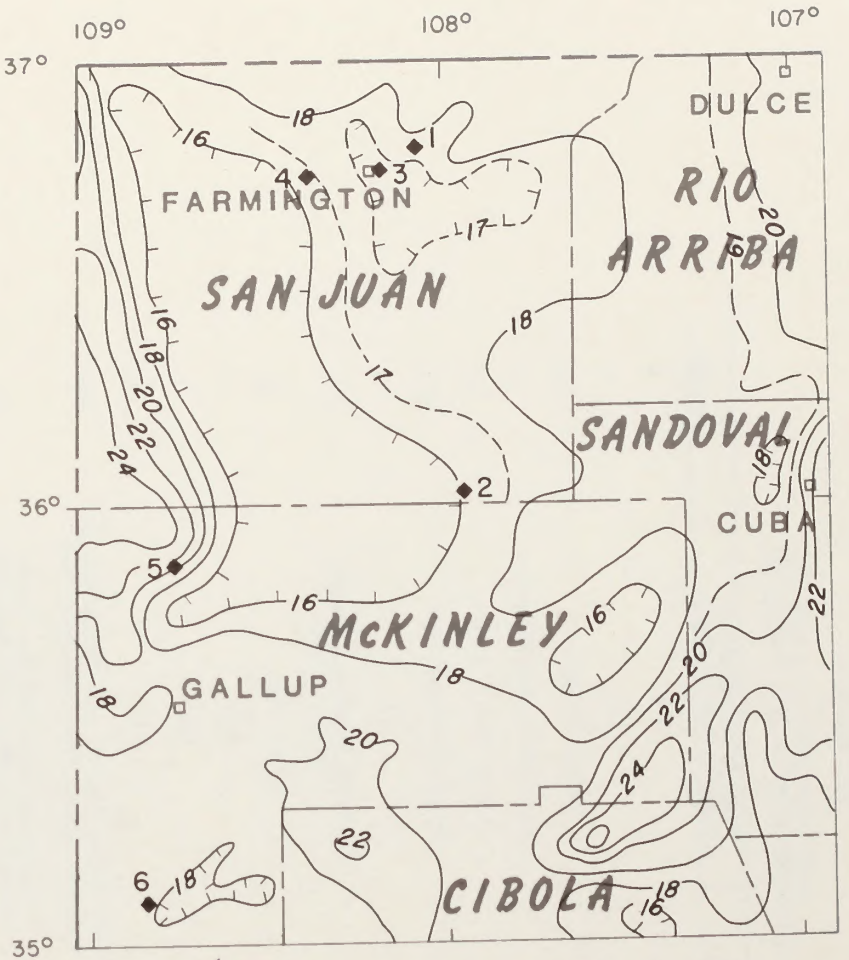
Notes: [a/] Maps showing the areal distribution of these floodplains were presented in the Site-Specific Analysis prepared for each tract (USDI, BLM, 1982).

[b/] Floodplain acreages on PRLA tracts are presented in Appendix F-12 of Final Environmental Assessment For Coal Preference Right Leasing New Mexico (USDI, BLM, 1981).



LINE OF EQUAL AVERAGE ANNUAL PRECIPITATION, IN INCHES (1931-60)

Source: USDA,SCS 1974



LINE OF EQUAL 10-YEAR 24-HOUR PRECIPITATION, IN TENTHS OF AN INCH

Source: USDA,SCS 1967

0 6 12 18 MILES

Average precipitation, in inches (1941-70)

Number on figure	Station	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1	AZTEC RUINS NAT MON	0.75	0.64	0.71	0.70	0.60	0.48	0.87	1.29	0.90	1.17	0.54	0.89	9.54
2	CHACO CANYON NAT MON	0.43	0.45	0.62	0.51	0.60	0.44	1.09	1.39	1.07	1.01	0.46	0.69	8.76
3	FARMINGTON 4 NE	0.54	0.46	0.52	0.60	0.47	0.46	0.78	1.18	0.85	1.08	0.47	0.66	8.07
4	FRUITLAND 2 E	0.53	0.41	0.50	0.59	0.46	0.36	0.75	1.03	0.85	1.03	0.47	0.66	7.64
5	TOHATCHI 1 ESE	0.59	0.50	0.66	0.55	0.53	0.41	1.59	2.00	1.18	1.10	0.49	0.81	10.41
6	ZUNI FAA AIRPORT	0.85	0.66	0.90	0.58	0.36	0.40	1.78	2.09	1.16	1.15	0.59	0.81	11.33

Figure B-1. Average annual and 10-year 24-hour precipitation.

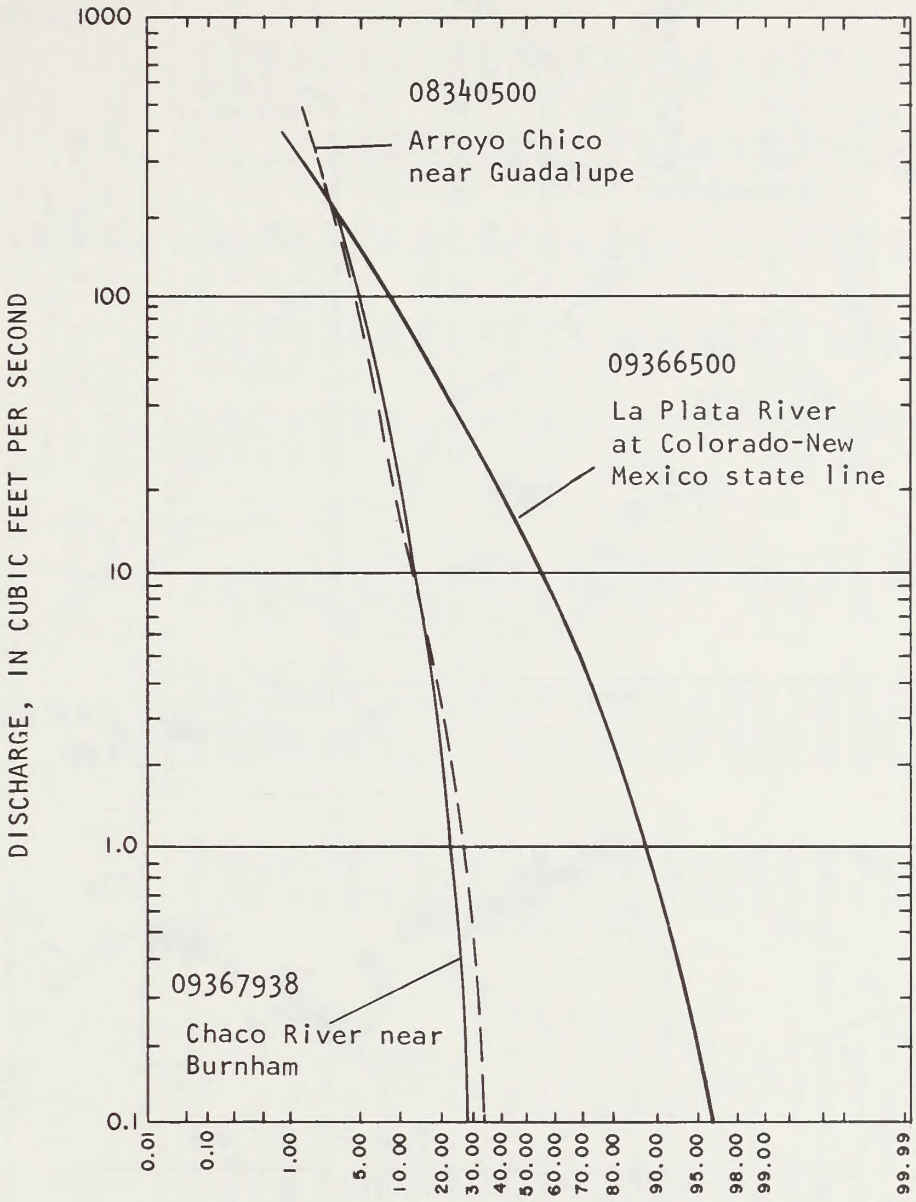


Figure B-2. Flow-duration curves for selected gaging stations.

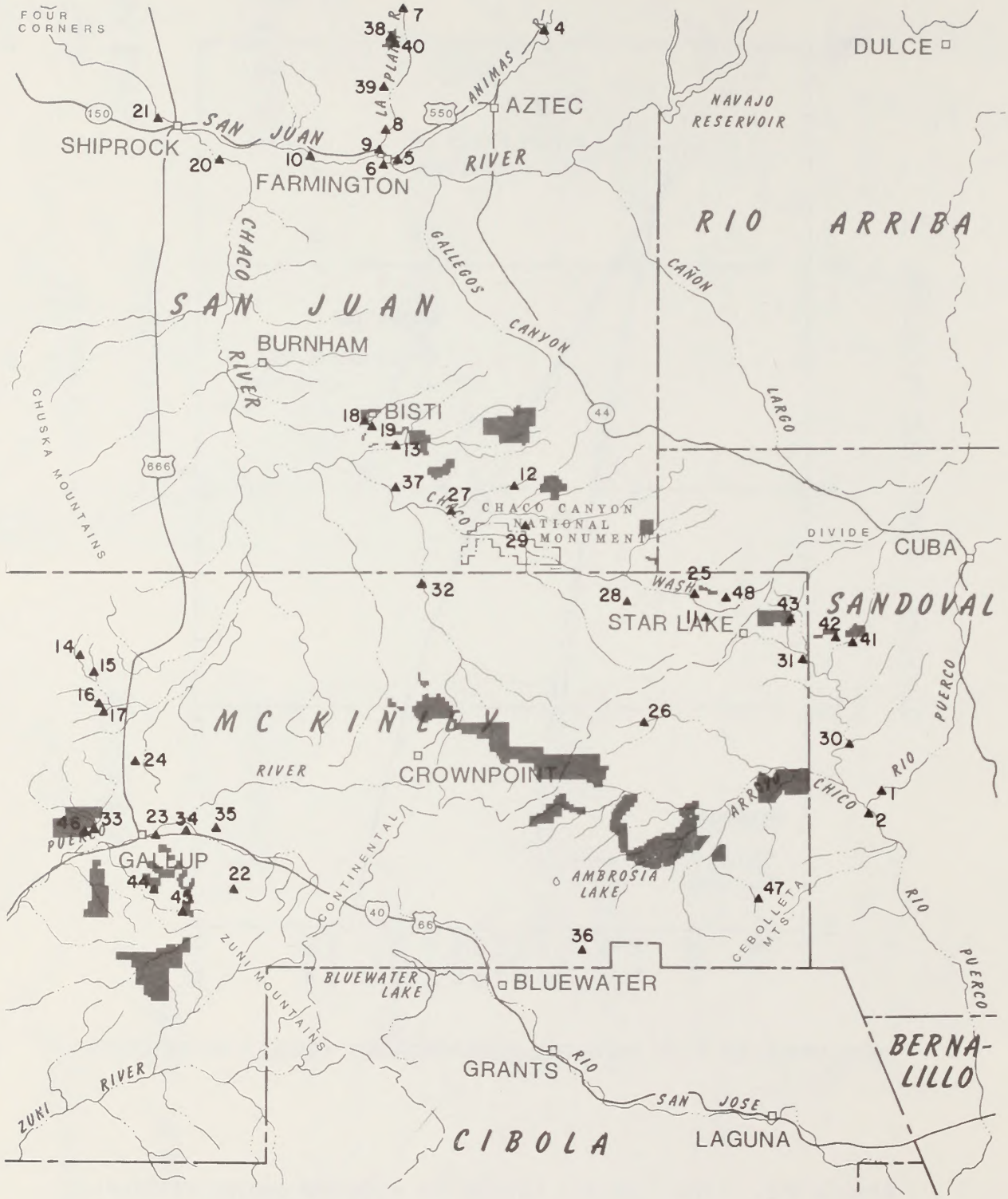


Figure B-3. Location of selected surface-water sites.

Table B-4 Streamflow characteristics for selected surface-water sites

Number on figure B-3	Station number	Site name	Latitude	Longitude	Drainage area (mi^2)	Flood magnitude, in cubic feet per second, for indicated recurrence interval, in years					Average annual discharge (ft^3/sec)
						2	5	10	25	50	
1	08334000	RIO PUERCO ABV ARROYO CHICO, N.M.	353808	1070956	420	2,290	3,460	4,260	5,290	6,070	13.4
2	08340500	ARROYO CHICO NR GUADALUPE, N.M.	353533	1071119	1,390	4,970	7,680	9,580	12,100	14,000	21.3
4	09363500	ANIMAS RIVER NR CEDAR HILL, N.M.	370217	1075225	1,090	5,710	8,100	9,730	11,800	13,500	898
5	09364500	ANIMAS RIVER AT FARMINGTON, N.M.	364312	1081208	1,360	5,980	9,030	11,200	14,000	16,300	919
6	09365000	SAN JUAN R AT FARMINGTON, N.M.	364322	1081330	7,240	7,930	11,100	13,200	15,800	17,600	2,373
7	09366500	LA PLATA R AT CO-N.M. STATE LINE	365951	1081117	331	750	1,570	2,310	3,480	4,540	34.9
8	09367400	LA PLATA R TRIB NR FARMINGTON	364710	1081331	1.03	57	222	451	952	1,540	0.03
9	09367500	LA PLATA R NR FARMINGTON, N.M.	364423	1081451	583	1,330	2,240	2,900	3,780	4,470	26.9
10	09367540	SAN JUAN R NR FRUITLAND, N.M.	364425	1082409	8,010	9,740	17,000	24,700	32,000	38,000	2,540
11	09367660	CHACO WASH NR STAR LAKE T.P., N.M.	355607	1073139	59.0	56	110	160	220	275	0.93
12	09367685	AH-SHI-SLE-PAH WASH NR KIMBETO, N.M.	360918	1075647	8.2	463	802	1,070	1,460	1,790	-
13	09367710	DE-NA-ZIN WASH NR BISTI T.P., N.M.	361351	1081157	184	1,390	1,930	2,280	2,700	3,000	-
14	09367840	YAZZIE WASH NR MEXICAN SPRGS, N.M.	355040	1085300	2.1	315	614	867	1,250	1,580	0.29
15	09367860	CHUSCA WASH NR MEXICAN SPRGS, N.M.	354840	1085050	8.7	1,110	2,410	3,590	5,490	7,230	0.38
16	09367880	CATRON WASH NR MEXICAN SPRGS, N.M.	354615	1084940	26.9	1,730	3,000	4,000	5,410	6,590	1.19
17	09367900	BLACK SPRGS WASH NR MEXICAN SPRGS, N.M.	354540	1084900	7.05	453	1,050	1,620	2,590	3,490	0.26
18	09367930	HUNTER WASH AT BISTI T.P., N.M.	361637	1081512	45.6	797	1,480	2,010	2,740	3,320	-
19	09367932	HUNTER WASH TRIB NR BISTI T.P., N.M.	361533	1081506	8.47	183	475	771	1,290	1,820	-
20	09367950	CHACO RIVER NR WATERFLOW, N.M.	364328	1083527	4,350	2,830	7,070	11,400	18,800	25,900	65.2
21	09368000	SAN JUAN R AT SHIPROCK, N.M.	364732	1084354	12,900	15,100	25,800	34,200	46,300	56,300	2,193
22	09395400	MILK RANCH CANYON NR FT WINGATE, N.M.	352555	1083330	14.0	63	188	336	626	938	1.10
23	09395500	PUERCO RIVER AT GALLUP, N.M.	353145	1084441	558	3,150	5,640	7,630	10,500	12,900	16.0
24	09395600	WAGON TRIAL WASH NR GAMERCO, N.M.	353900	1084700	0.42	70	177	287	481	670	-
25		ARROYO PUEBLO ALTO	355812	1073142	2.54	75	192	310	517	720	0.05
26		SANDOVAL ARROYO	354442	1073811	26.5	243	557	847	1,330	1,790	0.22
27		AH-SHI-SLE-PAH WASH	360614	1080514	43.1	399	945	1,460	2,330	3,180	0.67
28		PUEBLO PINTADO CANYON	355817	1073949	7.1	134	332	526	859	1,190	0.14
29		ESCAVADA WASH	360558	1075523	89.3	534	1,200	1,800	2,790	3,750	1.62
30		ARROYO PIEDRA LUMBRA	354147	1071309	78.0	499	1,130	1,700	2,650	3,560	2.19

Table B-4 Streamflow characteristics for selected surface-water sites - Concluded

Number on figure B-3	Station number	Site name	Latitude	Longitude	Drainage area (mi^2)	Flood magnitude, in cubic feet per second, for indicated recurrence interval, in years					Average annual discharge (ft^3/sec)
						2	5	10	25	50	
31		PAPERS WASH	355129	1071832	69.1	420	932	1,390	2,140	2,870	0.19
32		KIM-ME-NI-OLI WASH TRIB	355814	1080818	34.3	337	798	1,230	1,960	2,680	0.25
33		BURNED DEATH WASH	353144	1085147	53.3	383	869	1,310	2,040	2,750	1.90
34		PUERCO RIVER	353208	1084000	278	845	1,750	2,520	3,740	4,890	8.90
35		S. FK. PUERCO R TRIB	353143	1083614	11.2	157	375	584	935	1,280	0.57
36		ARROYO DEL PUERTO	352015	1074742	93.8	456	979	1,440	2,180	2,880	1.12
37		ROCK WASH	360913	1081247	4.6	12	37	65	116	169	0.10
38		MURPHY ARROYO TRIB	365650	1081402	0.2	14	41	70	126	184	0.01
39		PUMP CANYON	365102	1081403	0.4	12	37	65	116	169	0.02
40		MURPHY ARROYO	365619	1081258	5.8	34	94	157	270	384	0.38
41		SAN ISIDRO WASH	355327	1071242	64.1	856	1,890	2,800	4,200	5,440	1.89
42		SAN ISIDRO WASH TRIB	355405	1071442	0.6	14	41	70	126	184	0.02
43		PAPERS WASH TRIB	355535	1072108	3.7	14	41	70	126	184	0.13
44		BREAD SPRINGS WASH TRIB	352625	1084409	1.3	40	109	181	309	483	0.11
45		BREAD SPRINGS WASH	352403	1083953	6.9	193	473	743	1,180	1,600	0.76
46		DEFIANCE DRAW	353052	1085216	119	498	1,140	1,730	2,650	3,480	3.67
47		SALAZAR WASH (HEADWATERS)	352437	1072446	1.9	25	71	120	208	299	0.02
48		UNNAMED TRIB OF GAS TANK WASH	355743	1072812	.01	4	13	24	45	68	0.0

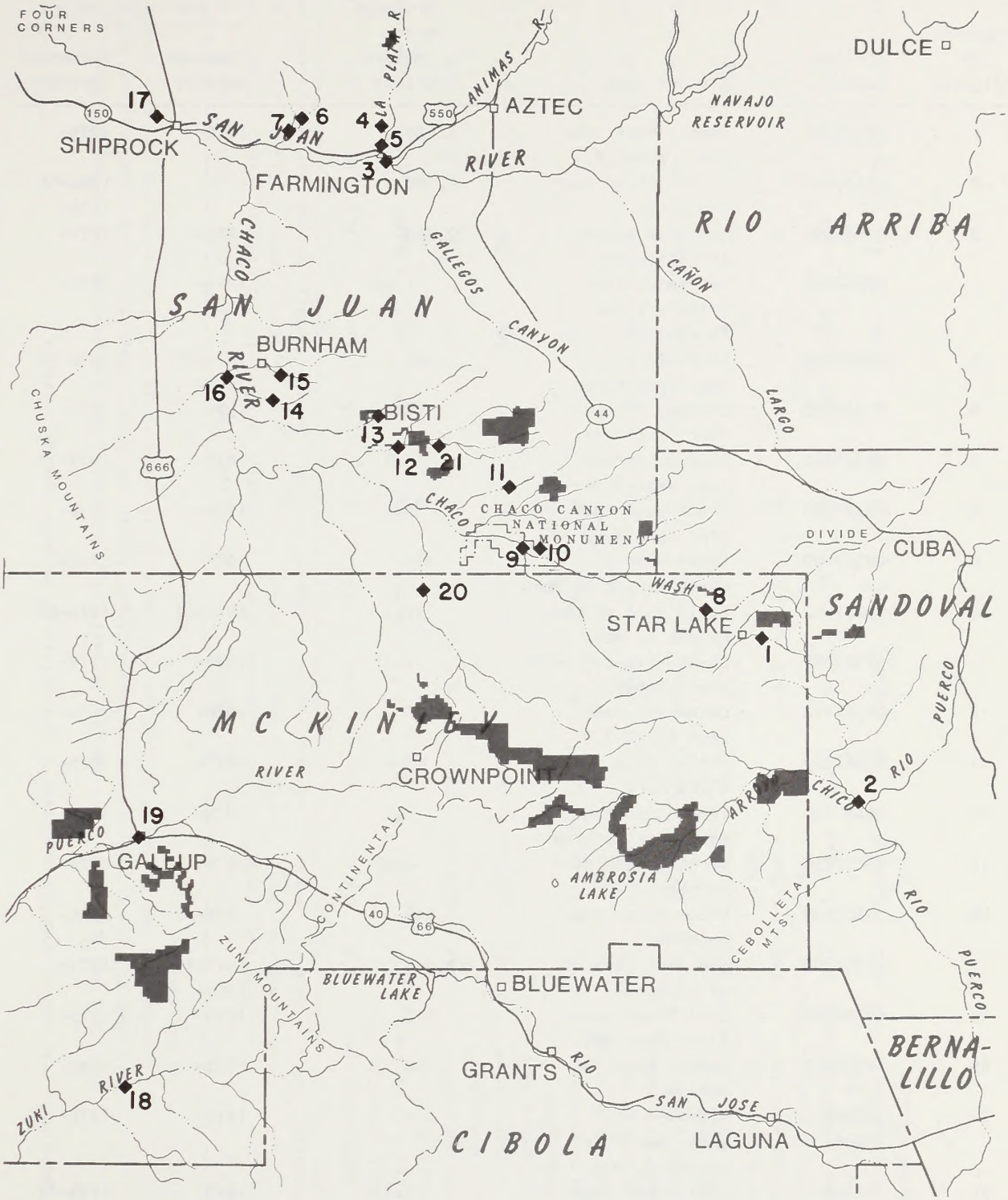


Figure B-5. Location of selected water-quality gaging stations.

Number on figure	Station number	Station name	Drainage area (square miles)	Period of record	
				Chemical quality	Suspended sediment
1	08334300	Papers Wash near Star Lake T.P.	20.3	1978-	1978-
2	08340500	Arroyo Chico near Guadalupe	1,390	-	1948-56 1978-
3	09365000	San Juan River at Farmington	7,240	1962-	1979-
4	09367400	La Plata River tributary near Farmington	1.03	1979-	1979-
5	09367500	La Plata River near Farmington	583	1970-73 1978-	1978-81
6	09367555	Shumway Arroyo near Fruitland	62.8	1976-	1976-
7	09367561	Shumway Arroyo near Waterflow	73.8	1975-	1975-
8	09367660	Chaco Wash near Star Lake T.P.	59.0	1978-	1978-
9	09367680	Chaco Wash at Chaco Canyon N. Mon.	578	1976-	1976-
10	09367682	Gallo Wash at Chaco Canyon N. Mon.	36.2	1979-81	1979-81
11	09367685	Ah-shi-sle-pah Wash near Kimbeto	8.21	1977-	1977-
12	09367710	De-na-zin Wash near Bisti T.P.	184	1976-	1976-
13	09367930	Hunter Wash at Bisti T.P.	45.6	1975-	1975-
14	09367934	Teec-ni-di-tso Wash near Burnham	7.2	1978-	1978-
15	09367936	Burnham Wash near Burnham	8.6	1978-	1978-
16	09367938	Chaco River near Burnham	3,640	1978-	1978-
17	09368000	San Juan River at Shiprock	12,900	1941-45 1951-	1951-
18	09386950	Zuni River above Black Rock Res.	810	1978-	1979-
19	09395500	Puerco River at Gallup	558	1975-	1980-
20	355841-108081810	Kim-me-ni-oli Wash near Chaco Canyon N. Mon.	-	1978-	1978-
21	361404-108074710	Coal Creek above Tanner Lake near Bisti T.P.	47.5	1975	1975-77

Source: Modified from Hejl (1982)

Table B-6. Results of chemical analyses of streamflow at selected gaging stations

All data are provisional and subject to revision. All values are the mean for the period of record. All chemical concentrations are expressed in milligrams per liter. Specific conductance is given in micromhos per centimeter at 25 degrees Celsius. pH is given in units. *indicates the value is based on one sample.

Number on figure B-5	Station number	Station name	Specific conductance	pH, range and mean	Calcium, dissolved	Magnesium, dissolved	Sodium, dissolved	Sodium adsorption ratio	Potassium, dissolved	Alkalinity, (as $CaCo_3$)	Sulfate, dissolved	Chloride, dissolved	Fluoride, dissolved	Sediment, suspended
1	08334300	Papers Wash near Star Lake T.P.	309	7.0-8.9 7.8	10	0.9	47	4	3	130	6.2	10	0.5	5,950
2	08340500	Arroyo Chico near Guadalupe	1,200	8.8*	50*	11*	750*	25*	4*	340*	1,300*	54*	1.1*	32,000
3	09365000	San Juan River at Farmington	514	6.9-8.9 7.2	56	8.6	40	1	2	110	140	9.5	0.3	789
4	09367400	La Plata River tributary near Farmington	1,040	6.6-8.2	100	11	160	10	3	140	540	6.1	0.7	135,000
5	09367500	La Plata River near Farmington	2,320	7.7-8.6 8.3	200	82	260	4	4	220	990	94	0.5	3,690
6	09367555	Shumway Arroyo near Fruitland	1,430	7.0-7.6 7.2	37	7.3	94	4	8	62*	220	10	0.8	224,000
7	09367561	Shumway Arroyo near Waterflow	6,790	2.4-10.4 7.4	340	190	1,400	17	15	160	3,900	350	5.9	13,600
8	09367660	Chaco Wash near Star Lake T.P.	589	6.8-8.8 7.5	9.3	0.7	71	7	3	130	73	11	0.5	17,700
9	09367680	Chaco Wash at Chaco Canyon N. Mon.	465	6.3-8.5 7.6	21	2.2	83	6	4	170	71	7.7	0.8	29,700
10	09367682	Gallo Wash at Chaco Canyon N. Mon.	432	7.1-8.3 7.8	16*	1.7*	43*	3*	7*	80*	56*	7.8*	0.2*	2,570
11	09367685	Ah-shi-sie-pah Wash near Kimbeto	823	6.6-8.6 7.6	7.6	0.8	130	13	4	190	170	23	0.5	51,200

Table B-6. Results of chemical analyses of streamflow at selected gaging stations - Concluded

Number on figure B-5	Station number	Station name	Specific conductance	pH, range and mean	Calcium, dissolved	Magnesium, dissolved	Sodium, dissolved	Sodium adsorption ratio	Potassium, dissolved	Alkalinity, (as $CaCo_3$)	Sulfate, dissolved	Chloride, dissolved	Fluoride, dissolved	Sediment, suspended
12	09367710	De-na-zin Wash near Bisti T.P.	718	6.5-8.5 7.8	8.6	0.6	140	14	3	180	130	7.0	1.2	53,400
13	09367930	Hunter Wash at Bisti T.P.	1,060	6.8-9.8 7.7	23	2.4	190	12	6	170	290	12	0.1	51,900
14	09367934	Teec-ni-di-tso Wash near Burnham	489	8.0-9.3 8.6	4.4	0.6	93	11	2	160	96	8.1	0.8	19,900
15	09367936	Burnham Wash near Burnham	770	7.3-9.3 8.1	11	3.3	150	11	4	240	160	8.8	0.8	102,000
16	09367938	Chaco River near Burnham	1,170	6.7-8.9 8.1	16	1.6	130	10	3	250	150	8.6	0.8	58,100
17	09368000	San Juan River at Shiprock	672	7.0-9.0 8.1	68	14	56	2	3	120	210	14	0.4	9,490
18	09386950	Zuni River above Black Rock Res.	650	7.7-8.4 8.1	52	19	62	2	4	180	100	17	0.3	355
19	09395500	Puerco River at Gallup	1,080	3.4-8.9 8.0	40	18	160	6	5	230	330	28	0.7	24,400
20	355841-108081810	Kim-me-ni-oli Wash near Chaco Canyon N. Mon.	1,720	7.4-9.0 8.2	16	2.1	510	33	5	310	720	82	1.7	4,540
21	361404-108074710	Coal Creek above Tanner Lake near Bisti T.P.	1,640	6.9-8.1 7.2	17	1.4	120	8	4	160	120	6.5	1.0	38,300

Table B-7. Results of trace-element analyses of streamflow at selected gaging stations

All data are provisional and subject to revision. All values are the mean for the period of record. All concentrations are expressed in micrograms per liter. * indicates the value is based on one sample. * * indicates the concentration is reported to the nearest 1/2 microgram.

Number on figure B-5	Station number	Station name	Boron, dissolved	Iron, dissolved	Manganese, dissolved	Chromium, dissolved	Aluminum, dissolved	Mercury, dissolved * *	Selenium, dissolved	Strontium, dissolved	Zinc, dissolved
3	09365000	San Juan River at Farmington	50	40	21	4	100*	0	1	920*	20
5	09367500	La Plata River near Farmington	110	40	250	5	40	0	2	2,100	20
7	09367561	Shumway Arroyo near Waterflow	2,100	690	480	10	-	0.5	150	2,600	80
9	09367680	Chaco Wash at Chaco Canyon N.Mon.	80	540	220	-	100	0	1	190	20
11	09367685	Ah-Shi-Sle-Pah Wash near Kimbeto	150	720	22	10	30*	0.5	2	150	60
12	09367710	De-Na-Zin Wash near Bisti T.P.	240	380	8	6	-	0	3	200	40
13	09367930	Hunter Wash at Bisti T.P.	210	1,200	80	10	-	0	6	650	30
16	09367938	Chaco River near Burham	200	430	12	7	200	1.0	3	270	20
17	09368000	San Juan River at Shiprock	130	20	71	5	30	0.5	2	620	40
19	09395500	Puerco River at Gallup	150	13,000	5*	8	-	0	38	-	9

Table B-8. Estimates of sediment yield from PRLA tracts.

PRLA number	Total surface area disturbed in acres	Erosion rate, in acre-feet per square mile per year	Sediment yield, in acre-feet per year
NM-585	2,811	1-3	4.4-13.2
NM-3752	3,760	1-3(50%) .2-.5 (50%)	3.6-10.3
NM-3753	2,951	1-3 (55%) .2-.5 (45%)	2.9-8.6
NM-3754	3,075	.2-.5 (80%) 1-3 (20%)	1.7-4.8
NM-3755	2,588	1-3 (10%) >3 (90%)	11.2-12.2
NM-3834	160	>3	>.75
NM-3835	4,500	1-3 (25%) .2-.5 (75%)	2.8-7.9
NM-3836	5,110	1-3	8-24
NM-3837	5,120	1-3 (70%) >3 (30%)	12.8-24.0
NM-3838	4,787	>3	>22.4
NM-3918	4,477	1-3 (42%) .2-.5 (42%) >3 (16%)	3.8-13.4
NM-3919	4,478	1-3	.7-21.
NM-6801	160	0-.2	0-.05
NM-6802	340	>3	>1.6
NM-6803	160	1-3	.25-.75
NM-6804	1,602	>3 (60%) 1-3 (40%)	5.5-7.5
NM-7235	160	.2-.5	.03-.12
NM-8128	4499	1-3 (90%) .2-.5 (10%)	6.3-19
NM-8129	1520	1-3 (45%) >3 (45%) .2-.5 (10%)	4.3-6.5
NM-8130	2133	1-3 (80%) .2-.5 (20%)	2.8-8.3
NM-8715	1921	.2-.5 (50%) 1-3 (50%)	1.8-5.2
NM-8717	600	1-3	.9-2.8
NM-8745	520	1-3	.8-2.4
NM-9764	240	1-3	.4-1.1
NM-11670	1119	.2-.5 (90%) >3 (10%)	2.1-5.2
NM-11916	160	>3	>.75

Surface acres disturbed are based on preliminary estimates and will be changed to reflect revised estimates.
Erosion rates from Figure 2-5 in the Draft Environmental Assessment for Coal Preference Right Leasing, New Mexico (USDI, BLM 1981a).

Table B-9. Estimates of sediment yield from coal tracts

Lease area	Total surface area disturbed in acres	Erosion rate, in acre-feet per square mile per year	Sediment yield, in acre-feet per year	Lease area	Total surface area disturbed in acres	Erosion rate, in acre-feet per square mile per year	Sediment yield, in acre-feet per year
La Plata 1	1070	.5-1	.8-1.7	Catalpa Canyon	730	.5-1	.6-1.1
La Plata 3	1128	.5-1	.9-1.8	Sandance	1597	.5-1	1.2-2.5
Johnson Trading Post	5112	.2-.5	1.6-4.0	Hogback	2198	.5-1	1.7-3.4
				Twin Buttes	12550	.5-1	9.8-19.6
Star Lake East 1	4130	1-3	6.5-19.4	Pinehaven	1831	.5-1	1.4-2.9
Star Lake West 2	2165	.2-.5	.7-1.7	Bread Springs 1	930	.5-1	.7-1.5
Kimbeto 2	1135	.2-.5	.4-.9	Gamerco 1 and 2	1942	.5-1	1.5-3.0
Gallo Wash 1	1906	1-3	3.0-8.9	Samson Lake 2/2	973	.5-1	.8-1.5
Bisti 1	4871	1-3	7.6-22.8	La Plata 2 *	160	.5-1	.1-.2
Bisti 2	4598	1-3	7.2-21.6	La Plata 4 *	160	.5-1	.1-.2
Bisti 4	3740	1-3	5.8-17.5	Star Lake East 2	160	1-3	.2-.7
Bisti 6/8	560	1-3	.9-2.6	Kimbeto *	160	1-3	.2-.7
Lee Ranch East	2196	1-3	3.4-10.3	Nageezi *	160	1-3	.2-.7
Lee Ranch Middle	8572	1-3	13.4-40.2	Gallo Wash *	-	1-3	-
Lee Ranch West	10132	1-3	15.8-47.5	Hospah	-	1-3	-
Divide	4325	1-3	6.8-20.3	Tah-ha-bah well *	160	.5-1	.1-.2
Crownpoint NE	10834	.5-1	8.5-16.9	Bread Springs 2	80	.5-1	.06-.1
Crownpoint East	12979	.5-1	10.1-20.3	Gamerco *	160	.5-1	.1-.2
Hospah 1	-	1-3	-	Samson Lake 1 *	160	.5-1	.1-.2
Chico Wash South	8572	<.2	<2.7				

* Indicates underground mine.

Surface acres disturbed are based on preliminary estimates and will be changed to reflect revised estimates
Erosion rates from Figure 2-5 in the Draft Environmental Assessment for Coal Preference Right Leasing, New Mexico (USDI, BLM 1981a)

Table B-10. Results of chemical analyses of runoff samples from mine-reclamation plots

All data are provisional and subject to revision. All chemical concentrations are expressed in milligrams per liter. Specific conductance is given in micromhos per centimeter at 25 degrees Celsius.

Location	Date of sample	Calcium, dissolved	Sodium, dissolved	Magnesium, dissolved	Potassium, dissolved	Sulfate, dissolved	Chloride, dissolved	Fluoride, dissolved	Alkalinity (as $CaCO_3$)	Sodium adsorption ratio	pH (units)	Specific conductance
San Juan Mine												
1974	07-12-82	40	29	7.1	18	7.0	13	0.3	220	1	6.9	460
reclamation	04-23-82	110	1,200	25	13	2,300	54	1.1	120	27	8.0	4,800
plot	10-02-81	39	47	6.7	22	8.0	15	0.3	200	2	7.1	500
	02-13-79	31	9.8	2.9	17	13	9.8	.1	100	0.5	-	-
1977	04-23-82 (upper stage)	310	800	41	14	2,300	22	.5	90	11	7.0	4,580
reclamation	04-23-82 (lower stage)	36	86	3.9	9	160	4.9	.8	120	4	7.4	610
plot	10-02-81	67	53	7.9	15	33	4.2	.5	270	2	6.9	625
	07-12-81	99	80	12	15	310	4.1	.4	210	2	6.7	965
	11-03-78	41	94	4.4	14	130	5.9	.5	210	4	7.0	640
	09-24-78	53	100	7.8	22	200	7.9	.5	210	3	7.4	940
Navajo Mine												
1973	04-23-82	31	10	4.5	9	17	2.5	.8	72	0.5	7.5	275
reclamation	03-05-80	19	11	2.4	8	57	2.1	.2	3	.6	6.8	188
plot	02-13-79	38	23	6.9	-	-	-	-	38	.9	6.8	410
1976	02-13-79 (upper stage)	13	100	0.9	4	-	-	-	43	7	6.8	590
reclamation	02-13-79 (lower stage)	18	210	1.6	6	43	39	.6	120	13	7.1	1,120
plot												
1978	02-13-79	150	130	27	12	610	26	.8	74	3	6.0	1,330
reclamation	09-24-78	280	440	74	13	1,600	130	1.9	130	6	7.2	3,400
plot	09-24-78	300	500	92	15	1,900	210	2.4	100	7	7.3	3,600

APPENDIX C
VEGETATION

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APPENDIX C

VEGETATION TYPES

Sagebrush Type: (041)

Big sagebrush is the dominant species. Sagebrush and perennial understory species density varies with soil type and past grazing use. Native vegetation production potential is good.

Grass species commonly present with big sagebrush include blue grama, galleta, bottlebrush squirreltail, western wheatgrass, sand dropseed and Indian ricegrass. Common forbs are wildbuckwheat, Russian thistle, tansymustard and wooly Indian-wheat. Broom snakeweed, fourwing saltbrush, pricklypear cactus, and winterfat are typical shrubs.

Pinyon-Juniper Type

The type is dominated by an overstory of pinyon pine and juniper species. Browse and grass production is greater when the stand is young. As the stand matures, shading increases and limits understory production. Isolated pockets of ponderosa pine, Douglas fir, quaking aspen, and narrowleaf cottonwood are found at heads of many rocky canyons.

Principal shrub species include true mountain-mahogany, antelope bitterbrush, oakbrush species, Mormon-tea, fourwing saltbush, pricklypear cactus, serviceberry and New Mexican cliffrose. Sparse understory cover includes blue grama, galleta, Indian ricegrass, prairie junegrass, sand dropseed, muttongrass and needle-and-thread. Scattered forbs are wildbuckwheat, penstemon species, fleabane, milkvetch species, and Hymenoxys species.

Grassland Type

The grassland type is not uniform throughout, but is dominated by galleta and blue grama. Areas of deep, coarse textured soils commonly support Indian ricegrass, galleta, blue grama, sand dropseed, fourwing saltbush and Mormon-tea. Swales, drainages, and low lying areas where soils are mildly alkali contain galleta, alkali sacaton, bottlebrush squirreltail, and western wheatgrass. Black greasewood, shadscale and fourwing saltbush are major scattered shrubs. Sunflower species annual saltbush species, and Russian thistle are common forbs. Upland soils of greater loam and clay content support a grass complex where galleta, blue grama, alkali sacaton, sand dropseed, and red threeawn dominate. Characteristic shrubs include fourwing saltbush, winterfat, sagebrush species, soapweed, Mormon tea, broom snakeweed, and rabbitbrush species. Wooly Indian-wheat, Russian thistle, wildbuckwheat, globmallow, and dock are common forbs.

Production of native vegetation for livestock use is good. Numerous Navajo family operations, as well as a few larger livestock operators are supported by this type.

Halophytic Type

Black greasewood dominates the aspect on alkaline soils, while fourwing saltbush occupies saline soils. They may be found growing together associated with mound saltbush shadescale, mat saltbrush and big sagebrush. Major grass species are alkali sacaton and other dropseed species galleta, western wheatgrass, bottlebrush squirreltail, and inland saltgrass. Forbs are frequent including Russian thistle, goosefoot species, stickseed pepperweed, fireweed, summercypress, pussytoes, annual saltbush species, dock, and seepweed. Vegetation production potential is limited by soil restrictions.

Fourwing saltbush and black greasewood comprise overstory vegetation. Fourwing saltbush is prevalent on saline soils while black greasewood is most prevalent on alkaline soils.

Common grasses are alkali sacaton, galleta, western wheatgrass, blue grama and inland saltgrass. Frequent forbs are Russian thistle, goosefoot species, stickseed, pussytoes pepperweed, and fireweed summercypress.

Vegetation consists of grasses, scattered shrubs and an abundance of annuals. The site can support a good grass cover when in good range condition and under proper range management. Alkali sacaton, black greasewood, fourwing saltbush, galleta, inland saltgrass, shadscale, and broom snakeweed comprise a major portion of the vegetation.

Potential perennial production is good for native saline and sodic tolerant species, under proper management.

Conifer Type

Overstory consists of mixed pinyon, juniper species and ponderosa pine, with Douglas fir occurring on moist, shaded sites. Pinyon and ponderosa pine are found on more exposed rocky areas. Quaking aspen also occurs in canyon heads. Understory is dominated by grasses such as blue grama, galleta, bottlebrush squirreltail, Arizona fescuse, prairie junegrass, muttongrass, mountain muhly, and western wheatgrass. Shrubs/species are not abundant.

Rock Outcrop Type

General aspect is rocky with scattered pinyon pine, juniper species and shrub. Common shrubs include New Mexico cliffrose, antelope bitterbrush, serviceberry, true mountain mahogany, big sagebrush, bud sagebrush, pricklypear cactus, broom snakeweed, fendler bush, rabbitbrush species, and Mormon-tea. Grasses are not common.

Majority of vegetation is located along channel edges. These edges often have a high watertable and support sub-irrigated riparian vegetation. The arroyo or river bed is usually barren. Riparian areas support a diverse complex of vegetation, with common species being cottonwood, saltcedar, Russian-Olive, sedges, rushes, inland saltgrass, western wheatgrass, and numerous forbs.

Duneland Type

It is composed of deep, excessively drained, gently to moderately sloping, shifting, nearly barren sand masses.

Vegetation is sparse. Woody species dominate, with shrubs often covering sand dune tops. Species occurring include black greasewood, fourwing saltbush, giant dropseed, Indian ricegrass, and alkali sacaton. Forb occurrence is limited.

Badlands Type

Vegetation is generally located in flats and intermittent channels which dissect the landform. Vegetation is sparse. Main grasses are alkali sacaton and galleta. Shrubs are black greasewood, shadescale, mound saltbrush, fourwing saltbush, broom snakeweed, rabbitbrush species, and Mormon tea. Principal forbs are Russian thistle, wildbuckwheat, annual saltbush species, four-o'clock, and composite species.

Riverwash-Wetland Type

Streamflow is highly variable, intermittent, and of short duration. These drainages are dry the majority of the year.

APPENDIX D
WILDLIFE

APPENDIX D

BIOLOGICAL ASSESSMENT

for

SAN JUAN RIVER REGIONAL COAL EIS

Prepared by

J. David Renwald

Wildlife Management Biologist

United States Department of Interior
Bureau of Land Management
Farmington Resource Area
Farmington, New Mexico

Federal Threatened or Endangered Species
Potentially Occurring Within the San
Juan Regional Coal ES Area
and Determination of Effect

1. Peregrine Falcon (Falco peregrinus) - No effect.

2. Bald Eagle (Haliaeetus leucocephalus) - No effect.

3. Black-footed Ferret (Mustela nigripes) - No Effect.

4. Colorado River Squawfish (Ptychocheilus lucius) - No effect.

5. Mesa-verde Cactus (Sclerocactus mesa-verdae) - No effect.

Proposed Species - None

Critical Habitat - None

Basis for Determination of Effect

1. Peregrine Falcon

In the Revised Check-list for the Birds of New Mexico by Hubbard (1978) it states that the peregrine falcon summers in montane areas statewide and breeds on cliffs near water. However, there are no known historical nesting records for the project area (Nelson, personal communication, 1982) though birds are seen during spring and fall migrations. Raptor nesting surveys (opportunistic) conducted for the BLM by Bio-West, Inc., an independent contractor, from July 1980 through September 1981 turned up no evidence of peregrine falcon nesting. Surveys were conducted from ground and helicopter routes in potentially suitable cliff areas. Raptor nest surveys conducted cooperatively by the USFWS and BLM using helicopters (April 6, 7, 1982 and June 2, 1982) also proved negative.

Consultation with the New Mexico Department of Game and Fish (NMDG&F) pertaining to Coal Unsuitability Criteria #10 was conducted during planning stages for the Chaco Unit Resource Analysis in 1980. At that time they stated that there were no habitats on federal lands critical or essential to T&E plants or animals (see attached Enclosure 1). Other sources used for determination of effect were: the U. S. Forest Service Run-Wild Program; New Mexico Heritage Program; A Wildlife Inventory of the Star Lake-Bisti Coal Lease Area by the Office of Biological Services, USFWS; and the most recent issues of American Birds from February, 1976 through March, 1982.

We feel that the general lack of water, adjacent cliff sites and preferred prey items preclude peregrine falcons from nesting or wintering in the project area.

2. Bald Eagle

The discussion concerning the peregrine falcon is applicable here. The same contracted and cooperative nesting surveys proved negative. Consultation with the state (see Enclosure 1) and numerous public meetings conducted by the Regional Coal Team in 1982 also resulted in no important habitat identified by NMDG&F. Winter bald eagle use along the La Plata River is not close enough to the La Plata 1-4 tracts to pose significant impacts (see Map D-1).

Sources and references are the same as for the peregrine falcon with the addition of Wintering Bald Eagle Studies compiled by Grubb (1979).

3. Black-footed Ferret

The potential for finding black-footed ferrets (BFF) does exist in northwest New Mexico (Findlay 1977, USFWS 1980). Recent surveys for BFF have proved negative within and adjacent to the EIS project area. These surveys include: the MAPCO, Inc. linear right-of-way completed in the summer of 1980; Investigations of Potential Black-footed Ferret Habitat in the Vicinity of Crownpoint, New Mexico done by Sverdrup & Parcel and Associates, Inc., occular reconnaissance of prairie dog towns within the study area inventoried by Bio-West, Inc. a contractor hired by BLM to do wildlife surveys in the Chaco-Bisti area; and numerous surveys done by USFWS prior to prairie dog poisoning programs in northwest New Mexico. A BFF sighting by Berger in 1977, at one time confirmed, is presently considered unconfirmed after recent conversations with Berger.

In order to provide for the welfare of potential BFF's mine plans within the project area will stipulate that any prairie dog towns larger than 50 acres that could be destroyed by mining activities will have a standard BFF survey. This is in keeping with your letter to the State Director, BLM, dated September 8, 1981.

Based on the above information we have determined no impact on BFF's.

4. Colorado River Squawfish

One of the assumptions of the PDEIS is that subsurface water in the vicinity of leased coal tracts would be used in mining operations, therefore we have determined that habitats of the Colorado River Squawfish in the San Juan and Animas Rivers would not be affected.

5. Mesa-verde Cactus

Potential habitat has been identified in the Chaco area for this species, however, no extensive ground surveys have been completed. Stipulations in mine plans would require surveys and mitigation to protect this species. No impact on this cactus is expected.

References

Peregrine Falcon:

Hubbard, J.P. 1978. Revised checklist of the Birds of New Mexico. NMSO Publication No. 6.

Nelson, A. 1982. Resident birder in northwest New Mexico for over 20 years. Regional compiler for American Birds.

New Mexico Dept. of Game and Fish. Letter dated May 9, 1980 concerning lands suitable for coal mining.

Arbib, R.A. Editor, American Birds. Issues from Vol. 30, No. 1 to Vol. 36, No. 2.

U. S. Fish & Wildlife Service, 1977. A Wildlife Inventory of the Star Lake-Bisti Coal Lease Area. 80 pp.

Bio-West, Inc., 1982. Wildlife Resource Inventory of the Chaco Strippable Coal Belt Area, New Mexico. Contract YA-553-CTO-1072 for USDI-BLM, Albuquerque, New Mexico. 241 pp.

Bald Eagle:

Same as above, plus:

Grubb, T. 1979. Wintering Bald Eagle Studies. USFS Rocky Mountain For. and Range Exp. Sta., Tempe, Az.

Black-footed Ferret:

Berger, S. 1977. Memo entitled "Black-footed Ferret Recovery Plan" from State Director, BLM, New Mexico, to Area Manager, USFWS, Pierre, South Dakota, listing sightings for this region.

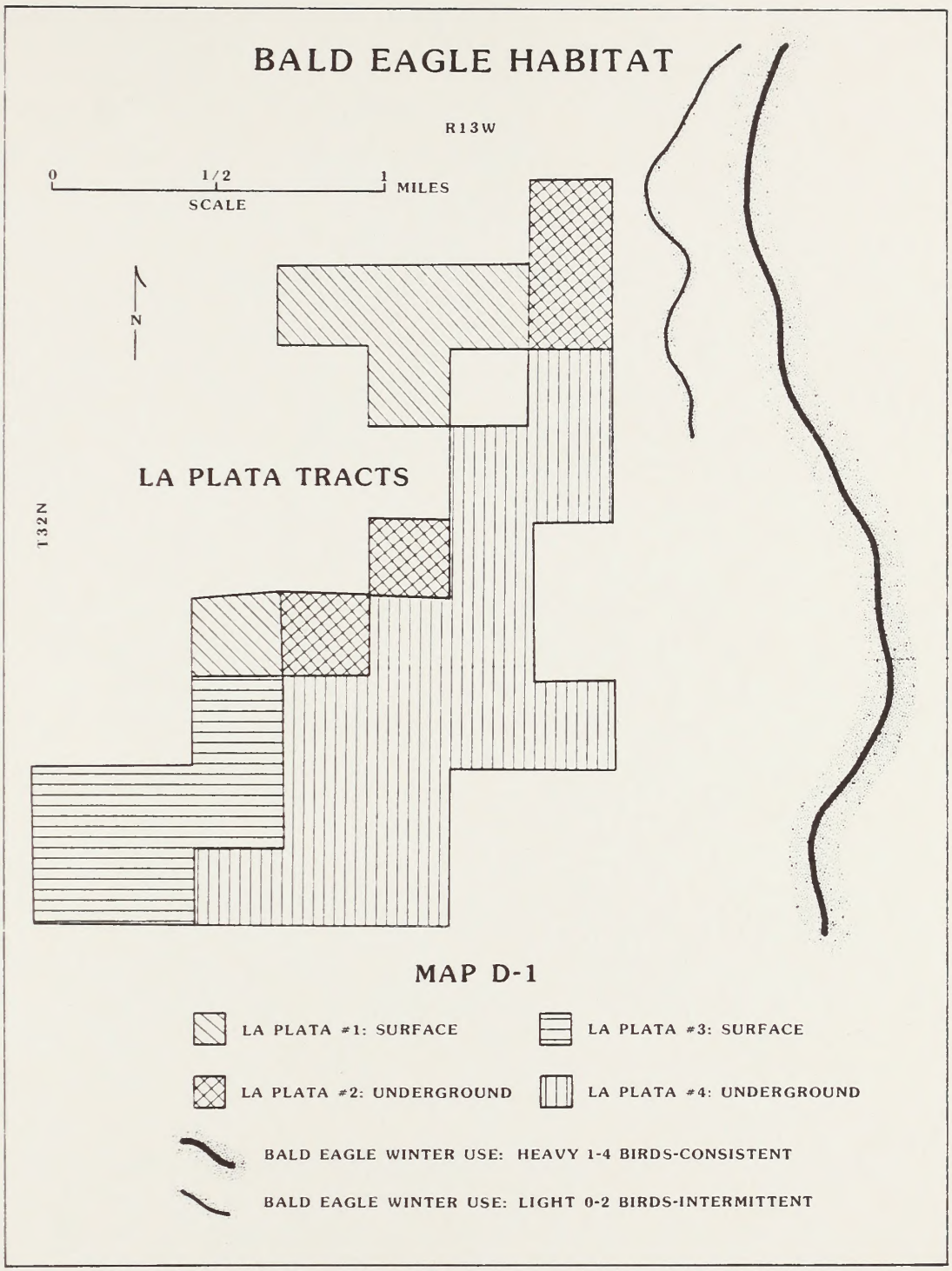
Berger, S. 1981. Personal conversations with BLM wildlife staff to the effect that sightings should be unconfirmed.

New Mexico Dept. of Game and Fish, 1979. Handbook of Species Endangered in New Mexico.

Sverdrup and Parcel and Associates. 1980. Investigations of Potential Black-footed Ferret Habitat in the Vicinity of Crown-point, New Mexico. 801 N. Eleventh St., St. Louis, Mo. 63101. Report done for EPA.

Colorado River Squawfish: New Mexico Dept. of Game and Fish. 1979. Handbook of Species Endangered in New Mexico.

Mesa-verde Cactus: Knight, D.J. 1981. Rare, Threatened, Endangered and Other Plants of Concern in the BLM Chaco-San Juan Planning Area of Northwestern New Mexico. N. M. Dept. of Nat. Res., N. M. Heritage Program, Santa Fe, New Mexico.


BALD EAGLE HABITAT
R13W
0
1/2
1
MILES
SCALE
N
LA PLATA TRACTS
132N
MAP D-1
LA PLATA #1: SURFACE
LA PLATA #3: SURFACE
LA PLATA #2: UNDERGROUND
LA PLATA #4: UNDERGROUND
BALD EAGLE WINTER USE: HEAVY 1-4 BIRDS-CONSISTENT
BALD EAGLE WINTER USE: LIGHT 0-2 BIRDS-INTERMITTENT

APPENDIX E
TRANSPORTATION AND LAND USES

APPENDIX E-1

RIGHTS-OF-WAY LOCATED ON PRLAs

PRLA Number	Right-of-Way Type	Right-of-Way Serial Number	Dimension (Feet)	Acreage
NM 585	Natural Gas Pipeline (Application)	NM 18724	50 x 9,000	10.33
	Powerline	NM 23125	20 x 7,000	3.21
	Powerline	NM 26950	20 x 4,000	1.84
	Powerline	NM 29865	20 x 10,300	4.73
	Natural Gas Pipeline	NM 042741	50 x 6,900	7.92
	Telephone Line and Pipeline	NM 066400	70 x 8,400	13.50
NM 3752	Proposed Star Lake Railroad - Atchison-Topeka and Santa Fe Railroad Co.[a/]	NM 29324	150-200 x 3,516.36	15.41
NM 3753	N/A			
NM 3754	Powerline	NM 12221	20 x 1,800	.83
	Proposed Star Lake Railroad - Atchison-Topeka and Santa Fe Railroad Co.[a/]	NM 29324	150-200 x 6,331.59	23.25
NM 3755	Powerline	NM 0556114	50 x 5,500	6.31
NM 3834	N/A			
NM 3835	N/A			
NM 3836	N/A			
NM 3837	N/A			
NM 3838	N/A			
NM 3918	Powerline	NM 0556114	60 x 15,300	21.07
NM 3919	Powerline	NM 0556114	60 x 3,900	5.37
NM 6801	Natural Gas Pipeline	NM 022491	50 x 6,000	6.89
	Natural Gas Pipeline	NM 022522	50 x 6,000	6.89
	Natural Gas Pipeline	NM 33177	50 x 6,000	6.89
NM 6802	Powerline (Application)	NM 34119	50 x 2,600	2.98
NM 6804	Powerline	NM 0556114	60 x 8,300	11.43
NM 7235	N/A			
NM 8128	Road Right-of-way	NM 30254	35 x 3,300	2.65
NM 8129	N/A			
NM 8130	Natural Gas Pipeline	NM 09148	50 x 2,900	3.33
NM 8715	Natural Gas Pipeline	NM 042741	50 x 2,500	2.87
	Powerline	NM 0559354	150 x 9,600	33.06
	Natural Gas Pipeline & Telephone Line	NM 066400	70 x 2,800	4.50
NM 8717	N/A			
NM 8745	N/A			
NM 9764	N/A			
NM 11670	Natural Gas Pipeline, Powerline, & Road	NM 34781	80 x 4,000	7.35
NM 11916	N/A			

Note: [a/]Proposed Facility - pending private land easement acquisition. Federal right-of-way grant issued 12-05-79.

APPENDIX E-2

RIGHTS-OF-WAY LOCATED ON COMPETITIVE COAL LEASE TRACTS

Tract Name	Right-of-Way Type	Right-of-Way Serial Number	Dimension (Feet)	Acreage
La Plata #1 Bypass	Natural Gas Pipeline	NM 26540	50 x 1,000	1.15
La Plata #2 [a]	N/A			
La Plata #3	N/A			
La Plata #4	N/A			
Johnson Trading Post	Natural Gas Pipeline (Mapco)	NM 36230	50 x 900	1.03
	Natural Gas Pipeline	NM 16556	50 X 900	1.03
	Natural Gas Pipeline	NM 17176	50 x 13,600	15.61
	Natural Gas Pipeline (Apln.)	NM 18724	50 x 13,500	15.60
	Powerline	NM 8601	20 x 3,900	1.79
	Powerline	NM 26729	20 x 8,400	3.86
	Powerline	NM 27146	20 x 1,600	.73
	Powerline	NM 3742	150 x 1,400	4.82
	Road	NM 30233	25 x 1,200	.69
Star Lake East #1	Powerline	NM 3742	150 x 8,200	28.24
Star Lake East	Powerline	NM 3742	150 x 6,500	22.38
(LC) [a]	Powerline	NM 29865	20 x 2,700	1.24
Star Lake West #2	Natural Gas Pipeline	NM 042741	50 x 4,500	5.17
Bypass	Natural Gas P/L and Telephone Line	SF 066400	70 x 4,500	7.23
Kimbeto #1 [a]	Powerline	NM 0556114	60 x 3,300	4.55
Kimbeto #2 Bypass	N/A			
Nageezi [a]	Natural Gas Pipeline	----------	50 x 8,500	9.76
Gallo Wash #1 Bypass	Natural Gas Pipeline	NM 09148	50 x 1,100	1.26
Gallo Wash #2 [a]	Natural Gas Pipeline (Proposed Shell CO_2 Line)	NM 29081	40 x 1,200	1.10
	Natural Gas Pipeline	NM 042739	50 x 3,100	3.56
	Natural Gas Pipeline	NM 0558168	50 x 3,100	3.56
	Natural Gas P/L and Telephone Line	SF 066400	70 x 3,100	4.98
	Natural Gas P/L and Powerline, & Road	NM 34781	80 x 1,200	2.20
	Powerline	NM 0559354	40 x 4,600	4.22
	Powerline	NM 27270	20 x 3,200	1.47
Bisti #1	Powerline (Apln.)	NM 34119	50 x 14,500	16.64
Bisti #2	Natural Gas Pipeline	NM 022491	50 x 6,000	6.89
	Natural Gas Pipeline	NM 022522	50 x 6,000	6.89
	Natural Gas Pipeline	NM 33177	50 x 6,000	6.89
	Powerline	NM 12221	20 x 500	0.23
	Powerline	NM 23125	20 x 2,000	0.92
Bisti #4 A & B	N/A			
Bisti #6 Bypass	Powerline	NM 12221	20 x 1,300	0.60
Lee Ranch East	Powerline	NM 0263365	100 x 5,800	13.32
Lee Ranch Middle	Powerline	NM 063642	100 x 5,800	13.32

Tract Name	Right-of-Way Type	Right-of-Way Serial Number	Dimension (Feet)	Acreage
Lee Ranch West	Powerline [a]	NM 063642	100 x 5,900	13.54
	Powerline [a]	NM 0263365	100 x 12,600	28.93
Divide	Proposed Star Lake Railroad: Atchison- Topeka and Santa Fe Railroad Co. [b]	NM 29324	225 x 1,022	5.28
	Powerline (230 KV) [c]	----------	100 x 3,900	8.95
	Four Corners-Ambrosia-Pajarito Powerline (500 KV R/W Issued) [a]	NM 41002	200 x 3,900	17.91
	Continental Divide Natural Gas Pipeline System-Proposed By Transwestern Pipeline Corp. [d]	NM 53144	40 x 3,000	2.75
Crownpoint Northeast	Powerline [a]	NM 40364	30 x 22,400	15.43
Crownpoint East	Powerline (230 KV) [c]	----------	100 x 20,800	47.75
	Four Corners-Ambrosia-Pajarito Powerline (500 KV R/W Issued) [a]	NM 41002	200 x 20,800	95.50
Hospah #1 Bypass	Proposed Continental Divide Pipeline System-Transwestern Pipeline Corp. [d]	NM 53144	40 x 9,200	8.45
Hospah #2 [e]	Proposed Star Lake Railroad: Atchison, Topeka and Santa Fe Railroad Co. [b]	NM 29324	200 x 5,839.68	26.81
Catalpa Canyon	N/A			
Sundance	N/A			
Tah-Ha-Bah Well (LC) [e]	N/A			
Hogback	N/A			
Twin Buttes (LC)	Roadway Materials Site - New Mexico State Highway Commission	NM 037898	----------	1.06
Pinehaven (LC)	Powerline [c]	NM 061426	100 x 7,900	18.14
Bread Springs #1 (LC) [e]	N/A			
Bread Springs #2 (LC) [e]	N/A			
Gamerco #1 Bypass	Powerline [c]	----------	50 x 2,600	2.98
Gamerco #1 (LC)	Proposed Con Paso Railroad Route Estimated) [f]	----------	200 x 1,500	6.89
Gamerco #2 (LC)	Proposed Con Paso Railroad (Route Estimated) [f]	----------	200 x 7,700	35.35
	Natural Gas Pipeline [c]	----------	50 x 10,700	12.28
	Powerline (115 KV) [c]	----------	50 x 7,200	8.26
Samson Lake #1 (LC)	Powerline (115 KV) [c]	----------	50 x 13,500	15.50
	Powerline (115 KV) [c]	----------	50 x 17,000	19.51
Samson Lake #2	Powerline (115 KV) [c]	----------	50 x 11,500	13.20
	powerline (115 KV) [c]	----------	50 x 9,400	10.79

Notes: [a] Existing facilities - R-O-W issued - mixed surface ownership (BLM, State, Private, Indian
[b] Proposed facilities - R-O-W issued.
[c] Existing facilities - No BLM administered surface is involved
[d] Proposed facilities - R-O-W application.
[e] Tracts identification for underground mining. Possible exemption from unsuitability criterion (43 CFR 3461.2). Mine plan is necessary for site specific asessment.
[f] Proposed facilities _ application status unknown because no BLM-administered surface is involved.

APPENDIX E-3

LAND USE PROPOSALS ON PRLA's AND COMPETITIVE COAL LEASE TRACTS

PRLA No./ Tract Name	Legal Description	Acreage	Lands Action
NM 3752	T. 23 N., R. 12 W., (NMPM) Sec. 19: Lots 5-20 (all)	650	Ute Mountain Exchange Withdrawal a/
NM 3754	T. 23 N., R. 12 W., (NMPM) Sec. 30: Lots 1-4, E1/2W1/2	640	Ute Mountain Exchange Withdrawal a/
NM 6803	T. 23 N., R. 11 W., (NMPM) Sec. 14: E1/2NE1/4	80	PLO 5721 - Navajo Exchange Withdrawal b/
Kimbeto #2	T. 23 N., R. 10 W., (NMPM) Sec. 13: NE1/4	160	PLO 5721 - Navajo Exchange Withdrawal c/
Nageezi	T. 23 N., R. 10 W., (NMPM) Sec. 6: Lots 3, 4, 5, SE1/4NW1/4 Sec. 8: S1/2	478	PLO 5721 - Navajo Exchange Withdrawal Sec. 6 b/ Sec. 8 c/
Nageezi	T. 24 N., R. 10 W., (NMPM) Sec. 21: S1/2SW1/4 Sec. 30: SE1/4 Sec. 33: SE1/4	400	PLO 5721 - Navajo Exchange Withdrawal d/
Twin Buttes	T. 14 N., R. 19 W., (NMPM) Sec. 26: NW1/4	160	PLO 5721 - Navajo Exchange Withdrawal c/
Bisti #1	Entire Tract	3,713	Public Law 96-475 - Bisti Coal Lease Exhange a/
Bisti #6	T. 23 N., R. 13 W., (NMPM) Sec. 15: N1/2NW1/4	80	Ute Mountain Exchange Withdrawal a/
Nageezi	T. 24 N., R. 11 W., (NMPM) Sec. 34: N1/2	320	Ute Mountain Exchange Withdrawal a/

Note: a/ Proposed for Exchange.
b/ Not included in Exchange Legislation.
c/ Scheduled for Exchange - Mining Claims are located on these lands.
d/ Included in Exchange Legislation.

APPENDIX E-4

TRANSPORTATION FACILITIES LOCATED ON FEDERAL COAL LANDS (PRLAs)

PRLA Number	Transportation Type And Agency or Company	Serial Number/ Road Number	Dimension (Feet)	Acreage
NM 585	Public Road: Bureau of Indian Affairs	47-A	20 x 9,200	4.22
NM 3752	Star Lake Railroad - Atchison-Topeka and Santa Fe Railroad Co.[a]	NM 29324	150-200 x 3,516.36	15.41
	Public Road: San Juan County	C-15	60 x 7,300	10.06
NM 3753	Public Road: San Juan County	C-15	60 x 8,900	12.26
NM 3754	Star Lake Railroad - Atchison-Topeka and Santa Fe Railroad Co.[a]	NM 29324	150-200 x 6,331.59	23.25
	Public Road: State of New Mexico Public Road:	371	60 x 1,900	2.62
	San Juan County	C-14	60 x 200	.28
NM 3755	Public Road: San Juan County[b]	A-01	60 x 2,700	3.72
NM 3834	N/A			
NM 3835	Public Road: San Juan County	C-15	60 x 6,000	8.26
NM 3836	Public Road: San Juan County	C-14	60 x 7,600	10.47
NM 3837	Public Road: San Juan County	C-14	60 x 14,900	20.52
NM 3838	N/A			
NM 3918	Public Road: State of New Mexico	56/57	60 x 14,300	19.70
	Public Road: San Juan County	A-09	60 x 8,600	11.85
	Public Road: San Juan County[b]	A-10	60 x 8,500	11.71
NM 3919	Public Road: State of New Mexico	56/57	60 x 3,500	4.82
NM 6801	Public Road: State of New Mexico	371	60 x 5,200	7.16
NM 6802	N/A			
NM 6803	Public Road: San Juan County	C-14	60 x 8,400	11.57
NM 6804	Public Road: State of New Mexico	56/57	60 x 9,500	13.09
	Public Road: San Juan County	A-30	60 x 1,400	1.93
	Public Road: San Juan County[b]	A-27	60 x 200	.28
	Public Road: San Juan County[b]	A-28	60 x 4,000	5.51
NM 7235	N/A			
NM 8128	Public Road: San Juan County[b]	A-16	60 x 9,700	13.36
NM 8129	N/A			
NM 8130	Public Road: Bureau of Indian Affairs	46	20 x 4,900	2.25
NM 8751	N/A			
NM 8717	N/A			
NM 8745	N/A			
NM 9764	N/A			
NM 11670	N/A			
NM 11916	N/A			

Notes: [a] Proposed facility - pending private land easement acquisition. Federal right-of-way grant issued 12/05/79.

[b] Roads maintained by San Juan County, but not considered county roads.

APPENDIX E-5

TRANSPORTATION FACILITIES LOCATED ON COMPETITIVE COAL LEASE TRACTS

Tract Name	Transportation Type and Agency or Company	Serial Number/ Road Number	Dimension (Feet)	Acreage
La Plata #1 Bypass	N/A			
La Plata #2[a]	N/A			
La Plata #3	N/A			
La Plata #4	N/A			
Johnson Trading Post	N/A			
Star Lake East #1	Public Road: BIA	47	20 x 2,200	1.01
	Public road: BIA	47-A	20 x 7,200	3.31
Star Lake East (LC)[a]	Public Road: BIA	47	20 x 7,000	3.21
	Public Road: BIA	47-A	20 x 3,300	1.52
Star Lake West #2 Bypass	N/A			
Kimbeto #1[a]	Public Road: San Juan County	A-27	60 x 13,500	18.60
	Public Road: San Juan County	A-30	60 x 5,000	6.89
Kimbeto #2 Bypass	N/A			
Nageezi[a]	Public Road: San Juan County	C-14	60 x 2,600	3.58
Gallo Wash #1 Bypass	N/A			
Gallo Wash #2[a]	Public Road: San Juan County	A-15	60 x 3,100	4.27
Bisti #1	Public Road: San Juan County	C-15	60 x 9,000	12.40
Bisti #2	Public Road: State of New Mexico	371	60 x 3,500	4.82
Bisti #4 A & B	N/A			
Bisti #6 Bypass	Public Road: State of New Mexico	371	60 x 3,200	4.41
Lee Ranch East	Public Road: McKinley County	19	60 x 1,100	1.52
Lee Ranch Middle	N/A			
Lee Ranch West	N/A			
Divide	Star Lake Railroad: Atchison-Topeka and Santa Fe Railroad Co.[a]	NM 29324	225 x 1,022	5.28
	Public Road: BIA	48-C	20 x 1,300	0.60

Tract Name	Transportation Type and Agency or Company	Serial Number/ Road Number	Dimension (Foot)	Acreage
Crownpoint Northeast	Public Road: State of New Mexico	56/57	60 x 17,500	24.10
	Public Road: State of New Mexico	371	60 x 11,900	16.39
Crownpoint East	Public Road: BIA	48-A	20 x 13,000	5.97
Hospah #1 Bypass	N/A			
Hospah #2[a]	Star Lake Railroad: Atchison-Topeka and Santa Fe Railroad Co.[b]	NM 29324	200 x 5,839.68	26.81
Chico Wash South (LC	Public Road: McKinley County	C-19	60 x 21,400	29.48
Catalpa Canyon	N/A			
Sundance	N/A			
Tah-Ha-Bah Well (LC)[a]	N/A			
Hogback	N/A			
Twin Buttes (LC)	Public Road: McKinley County	2	60 x 3,000	4.13
	Public Road: McKinley County	26	60 x 15,000	20.66
Pinehaven (LC)	Public Road: State of New Mexico	32	60 x 5,300	7.30
	Public Road: McKinley County	24	60 x 400'	0.55
Bread Springs #1 (LC)[a]	N/A			
Bread Springs #2 (LC)[a]	N/A			
Gamerco #1 Bypass	N/A			
Gamerco #1 (LC)	Proposed Con Paso Railroad (Route Estimated)[c]	---------	200 x 1,500	6.89
Gamerco #2 (LC)	Proposed Con Paso Railroad (Route Estimated)[c]	---------	200 x 7,700	35.35
Samson Lake #1 (LC)[a]	Public Road: McKinley County	1a	60 x 11,500	15.84
	Public Road: McKinley County	1d	60 x 12,200	16.80
Samson Lake #2	Public Road: McKinley County	1a	60 x 2,000	2.75
	Public Road: McKinley County	1d	60 x 2,500	3.44

Notes:
[a] Tracts identified for underground mining. Possible exemption from unsuitability criterion (43 CFR 3461.2). Mine plan is necessary for site-specific assessment.
[b] Proposed facility - pending private land easement acquisition. Federal right-of-way grant issued 12/05/79.
[c] Proposed facility - application status unknown because no BLM-administered surface is involved.

APPENDIX F
AMERICAN INDIAN CONCERNS

Библиотека Института Гёте
www.goethe.de/ins/ru/lp/bib.htm

APPENDIX F - 1
NAVAJO OCCUPANCIES ON THE PRLAs

Lease Application No.	Legal Description	Surface Ownership	Residence Group	Head of Household	Livestock Permit	IMPROVEMENTS No. & Type of Residence	IMPROVEMENTS Associated Structures	IMPROVEMENTS Other
SURFACE MINEABLE PRLAs								
NM-585	T. 19 N., R. 5 W.							
	Sec. 3: S½	Public Domain	Group A	A1: Rita Mace A2: Thomas Mace		1 frame house 1 frame house	Corrals, Shed	Water line, fenced garden
	Sec. 6: SW¼	Homestead	Group B	B1: Isabelle Salzar, Manuel Salzar	BIA-Tribe	2 frame houses	Fences, barn, corrals, shed	
				B2: Sam & Barbara Peshlakai	BIA-Tribe	1 trailer house	Church, Shelter	
	Sec. 9: NE¼	Indian Allotment (No. 062008)	Group C	C1: Raymond & Irene Ignacio	BIA-Tribe	2 frame houses	Corrals, sheds	2 acre farm
	SUBTOTALS	3 RESIDENCE GROUPS		5 HOUSEHOLDS		7 RESIDENCES		
NM-8717	T. 20 N., R. 5 W.							
	Sec. 35: NE¼	Indian Allotment (No. 434)	Group A	A1: Marie Sandoval A2: Velma Toledo A3: Wayne Toledo	BIA-Tribe	1 hogan 1 frame house 1 frame house	Corrals, Shed	Water line
	SUBTOTALS	1 RESIDENCE GROUP		3 HOUSEHOLDS		3 RESIDENCES		
NM-8715	T. 20 N., R. 7 W.							
	Sec. 3: SE¼	Indian Withdrawal (PLO 2198)	Group A	A1: Tom Tomasito	BIA-Tribe	2 frame houses		
	SUBTOTALS	1 RESIDENCE GROUP		1 HOUSEHOLD;		2 RESIDENCES		

APPENDIX F-1

(CONTINUED)

Lease Application No.	Legal Description	Surface Ownership	Residence Group	Head of Household	Livestock Permit	IMPROVEMENTS No. & Type of Residence	Associated Structures	Other
NM-8130	T. 20 N., R. 7 W.,							
	Sec. 2: NE¼	Indian Allotment (No. 302)	Group A	A1: Julia Tsosie	BIA-Tribe	1 frame house		
				A2: Martha Ramone		2 hogans 1 frame house		
				A3: Alice Ramone		1 hogan	Corrals	
				A4: Albert & Martha Toledo	BIA-Tribe	1 frame house		
				A5: Chee Ramone		2 hogans		
	Sec. 12: NE½	Public Domain	Group B	B1: Marvin & Anna Dennison	BIA-Tribe	1 hogan 1 frame house		
				B2: Alice Jim	BIA-Tribe	1 hogan	Corrals	
				B3: Jimmie Lamone	BIA-Tribe	1 frame house		
	SUBTOTALS	2 RESIDENCE GROUPS		8 HOUSEHOLDS		12 RESIDENCES		
NM-8128	T. 21 N., R. 8 W.,							
	Sec. 10: SE¼	Indian Allotment (No. 315)	Group A	A1: Mrs. Charley Brown	BIA-Tribe	1 hogan 1 frame house	Corrals, sheds	Fenced garden
				A2: Hoskie Brown		1 hogan 1 frame house		
	Sec. 15: NE¼	Indian Allotment (No. 308)	Group B	B1: Jack & Nancy Thomas	BIA-Tribe	2 hogans 1 frame house 1 trailer house	Corral	Fenced garden
	Sec. 15: NW¼	Indian Allotment (No. 312)	Group C	C1: Bert Mescal	BIA-Tribe	1 frame house		
	Sec. 22: SW¼	Public Domain	Group D	D1: Lucille Cayaditto	BIA-Tribe	1 frame house	Corrals	

APPENDIX F-1

(CONTINUED)

Lease Application No.	Legal Description	Surface Ownership	Residence Group	Head of Household	Livestock Permit	IMPROVEMENTS No. & Type of Residence	IMPROVEMENTS Associated Structures	IMPROVEMENTS Other
NM-8128 (Cont'd)	Sec. 34: S½	Indian Allotment (No. 079848)	Group E	E1: Elise Mitchell		1 frame house		
				E2: Mary Nelson	BIA-Tribe	1 frame house		Red dog gravel
				E3: Shirley Nelson		1 frame house		
				E4: Kee Nelson		1 frame house		
	SUBTOTALS	5 RESIDENCE GROUPS		9 HOUSEHOLDS		14 RESIDENCES		
NM-3918	T. 22 N., R. 10 W.							
	Sec. 17: SW¼	Public Domain	Group A	A1: Andy Tsosie	BLM	1 frame house	Corral	
	Sec. 19: SW¼	Public Domain	Group B	B1: Willie Yazzie	BLM	1 frame house 1 trailer house	Corrals	
	Sec. 23: SE¼	Public Domain	Group C	C1: Cecil Werito	BLM	1 frame house	Corrals,	
				C2: Neilwood Willeto	BLM	1 frame house	Stulls,	
				C3: Jim Beyale	BLM	2 frame houses	Sheds	
	Sec. 24: W½	Public Domain	Group D	D1: Mary Trujillo		1 frame house	Corrals,	
				D2: Neilwood Willeto	(Cf. above)	2 frame houses	Sheds	
				D3: Jim Beyale	(Cf. above)	1 frame house		
	SUBTOTALS	4 RESIDENCE GROUPS		8 HOUSEHOLDS		11 RESIDENCES		

APPENDIX F-1

(CONCLUDED)

Lease Application No.	Legal Description	Surface Ownership	Residence Group	Head of Household	Livestock Permit	IMPROVEMENTS No. & Type of Residence	Associated Structures	Other
UNDERGROUND MINEABLE PRLA								
NM-6801	T. 24 N., R. 13 W							
	Sec. 20: SW¼	Navajo Tribe	Group A	A1: Ben Harris	BIA-Tribe	1 hogan 1 stone house	Corrals, Cellar-type shed	2 acre farm
				A2: Margery Begay	BIA-Tribe	1 trailer house	Corral, Cellar-type shed	
				A3: Anna Begay		1 trailer house	fenced area with loading dock	
				A4: Daniel Begay		1 hogan		
	Sec. 20: NE½	Navajo Tribe	Group B	B1: Unknown		1 frame house	Corral, fence	
	SUBTOTALS	2 RESIDENCE GROUPS		5 HOUSEHOLDS		6 RESIDENCES		
	TOTALS	18 RESIDENCE GROUPS		39 HOUSEHOLDS		55 RESIDENCES		

Source: BLM, Albuquerque District, Farmington Resource Area Files

APPENDIX F-2
NAVAJO OCCUPANCIES ON SURFACE MINEABLE TRACTS ON COMPETITIVE COAL LEASE TRACTS

TRACT NAME	Legal Description	Surface Ownership	No. of Residence(s)	Other
Pinehaven	T. 12 N., R. 18 W.,			
	Sec. 4: NW¼	Tribal Land	1	
	Sec. 4: SW¼	Private	4	
	Sec. 10: NE¼	Tribal Land	2	
	Sec. 11: SW¼	Indian Allotment	3	
	T. 13 N., R. 17 W.,			
	Sec. 16:	Tribal Land	50	
	Sec. 19: NE¼	Private	0	1 Large Building
	Sec. 20: E½	Indian Allotment	3	
	Sec. 21:	Tribal/Indian Allotment	6	
	Sec. 30: NW¼	Tribal Land	9	
	Sec. 31: NE¼	Private	1	
	Sec. 32: SE¼	Tribal Land	1	
	T. 13 N., R 18 W.,			
	Sec. 24: SW¼	Tribal Land	1	
	Sec. 25: SE¼	Tribal Land	1	
	Sec. 28: NW¼	Tribal Land	10	
	Sec. 29: NE¼	Tribal Land	2	
	Sec. 30: SE¼	Private	5	
	Sec. 33: NW¼	Tribal Land	4	
	Sec. 34:	Tribal Land	3	
		SUBTOTAL	106	
Sundance	T. 14 N., R. 17 W.,			
	Sec. 4: SW¼	Indian Allotment	2	
	Sec. 8: NE¼	Indian Allotment	3	
	Sec. 17: NE¼	Tribal Trust	2	
		SUBTOTAL	7	

APPENDIX F-2

(CONTINUED)

TRACT NAME	Legal Description	Surface Ownership	No. of Residence(s)	Other
Bread Springs #1	T. 14 N., R. 17 W.,			
	Sec. 9: SE¼	Tribal Trust	8	
	Sec. 10: NW¼	Public	3	
	Sec. 10: SW¼	Indian Allotment	2	
	Sec. 16: E½	Tribal Trust/State Leased to Tribe	4	
		SUBTOTAL	17	
Twin Buttes	T. 14 N., R. 19 W.,			
	Sec. 2: NW¼	Indian Allotment	5	
	Sec. 3: N½	2198	8	
	Sec. 4: E½	Indian Allotment	4	
	Sec. 9: E½	Indian Allotment	3	
	Sec. 10: SE¼	Indian Allotment	4	
	Sec. 10: NW¼	Indian Allotment	2	
	Sec. 10: SW¼	Indian Allotment	2	
	Sec. 11: W½	2198	12	
	Sec. 14: E½	Indian Allotment	8	
	Sec. 15: W½	2198	8	
	Sec. 22:	Indian Allotment	5	
	Sec. 23: N½	2198	6	
	Sec. 26: NW¼	Indian Allotment	2	
	Sec. 27:	2198	10	
	Sec. 34: NW¼	Tribal Trust	2	
	T. 15 N., R. 19 W.,			
	Sec. 34: NW¼	Indian Allotment	4	
	Sec. 34: SW¼	Indian Allotment	8	
		SUBTOTAL	93	

APPENDIX F-2

(CONTINUED)

TRACT NAME	Legal Description	Surface Ownership	No. of Residence(s)	Other
Divide	T. 15 N., R. 10 W.,			
	Sec. 4: NW¼	Indian Allotment	3	
		SUBTOTAL	3	
Hogback	T. 15 N., R. 18 W.,			
	Sec. 19: SW¼	Indian Allotment	14	
	Sec. 24: NE¼	Private		Trailer court with approximately 150 trailers.
	Sec. 24: NW¼	Indian Allotment	1	
	Sec. 24: SW¼	Indian Allotment	2	
		SUBTOTAL	17	
Samson Lake #2	T. 15 N., R. 19 W.,			
	Sec. 7: NW¼	2198	1	
	Sec. 8: SE¼	Indian Allotment	2	
	T. 15 N., R. 20 W.,			
	Sec. 1: NW¼	2198	4	
	Sec. 2: SW¼	Tribal Trust	4	
	Sec. 12: SE¼	Private	4	
		SUBTOTAL	15	
Gamerco #1 (LC)	T. 16 N., R. 19 W.,			
	Sec. 28: SE¼	Indian Allotment	2	
		SUBTOTAL	2	
Gamerco #1 Bypass (HC)	T. 16 N., R. 19 W.,			
	Sec. 34: SW¼	Indian Allotment	2	
		SUBTOTAL	2	

APPENDIX F-2

(CONTINUED)

TRACT NAME	Legal Description	Surface Ownership	No. of Residence(s)	Other
Crownpoint Northeast	T. 18 N., R. 12 W.,			
	Sec. 6: SE¼	Indian Allotment	3	
	Sec. 8: NW¼	Indian Allotment	1	
	Sec. 20: SW¼	Public	3 b/	
	Sec. 22: SW¼	Homestead	2	
	Sec. 26: NE¼	Indian Allotment	4	
	Sec. 26: SE¼	Indian Allotment	1	
	Sec. 26: NW¼	Indian Allotment	2	
	Sec. 28: NE¼	Indian Allotment	1	
	Sec. 28: SE¼	Indian Allotment	7	
	Sec. 28: SW¼	Indian Allotment	4	
	Sec. 30: NE¼	Indian Allotment	1	
	Sec. 30: NW¼	Indian Allotment	2	
	Sec. 31: NE¼	Homestead	1	
	T. 18 N., R. 13 W.,			
	Sec. 22: SE¼	Indian Allotment	4	
	Sec. 22: SW¼	Indian Allotment	1	
		SUBTOTAL	37	
Johnson Trading Post	T. 19 N., R. 3 W.,			
	Sec. 7: NW¼	Indian Allotment	7	
	T. 19 N., R. 4 W.,			
	Sec. 9: NE¼	Public	1 b/	
		SUBTOTAL	8	
Crownpoint East	T. 17 N., R. 11 W.,			
	Sec. 1: NE¼	Indian Allotment	1	
	Sec. 2: SW¼	Indian Allotment	4	
	Sec. 4: SW¼	Indian Allotment	1	
	Sec. 11:	2198	11	
	Sec. 14: SE¼	Tribal Trust	4	
	Sec. 22: NE¼	Indian Allotment	3	
	Sec. 23: NE¼	2198	1	
		SUBTOTAL	25	

APPENDIX F-2

(CONTINUED)

TRACT NAME	Legal Description	Surface Ownership	No. of Residence(s)	Other
STAR LAKE EAST #1	T. 19 N., R. 5 W.,			
	Sec. 5: NE¼	Public	2	
	T. 20 N., R. 5 W.,			
	Sec. 33: SE¼	Public	1	
	Sec. 34: NW¼	Public	2 b/	
	Sec. 35: NW¼	Indian Allotment	6	
		SUBTOTAL	11	
Bisti #6	T. 23 N., R. 13 W.,			
	Sec. 15: NE¼	Indian Allotment	1	
	Sec. 17: NW¼	Indian Allotment	1	
		SUBTOTAL	2	
Bisti #2	T. 24 N., R. 13 W.,			
	Sec. 29: NW¼	Navajo Tribe	0	1 hogan used by Project Concern for dental work
	Sec. 31: NE¼	Public	0	2 buildings belonging to United Methodith Mission
		SUBTOTAL	0	
		TOTAL RESIDENCES	345	

Source: BLM, Albuquerque District, Farmington Resource Area Files

Note: a/ Unoccupied tracts: Catalpa Canyon, Lee Ranch East, Lee Ranch Middle, Lee Ranch West, Hospah #1, Star Lake West #2, Gallo Wash #1, Kimbeto #2, Bisti #1, Bisti #4, La Plata #1, La Plata #3.

b/ Located on or near the boundary of lands included in the proposed Navajo Exchange (See DOI, BLM, 1979).

APPENDIX F-3

NAVAJO OCCUPANCIES ON UNDERGROUND MINEABLE COMPETITIVE COAL LEASE TRACTS a/

TRACT NAME	LEGAL DESCRIPTION	SURFACE OWNERSHIP	NO. OF RESIDENCE(S)
Tah-Ha-Ba Well	T. 14 N., R. 17 W.,		
	Sec. 6: E½	Tribal Trust	4
	Sec. 6: NW¼	Tribal Trust	3
	T. 14 N., R. 18 W.,		
	Sec. 3: SE¼	2198	2
	Sec. 10: NW¼	Indian Allotment	5
	Sec. 14: NE¼	Indian Allotment	3
	Sec. 14: NW¼	Indian Allotment	4
		SUBTOTAL	21
Gamerco #2	T. 16 N., R. 19 W.		
	Sec. 27: SW¼	Private	3
	Sec. 28: SE¼	Indian Allotment	3
	Sec. 28: SW¼	Indian Allotment	4
	Sec. 30: SE¼	Indian Allotment	5
	Sec. 32: NE¼	Indian Allotment	5
	Sec. 32: NW¼	Indian Allotment	6
	Sec. 34: NE¼	Indian Allotment	1
	Sec. 34: NW¼	Indian Allotment	8
		SUBTOTAL	35
Samson Lake #1	T. 15 N., R. 19 W.,		
	Sec. 7: SW¼	Tribal Fee	2
	Sec. 8: SE¼	Indian Allotment	5
	Sec. 8: SW¼	Indian Allotment	6

APPENDIX F-3

(CONTINUED)

TRACT NAME	LEGAL DESCRIPTION	SURFACE OWNERSHIP	NO. OF RESIDENCE(S)
Samson Lake #1 (Cont'd)	T. 15 N., R. 20 W.		
	Sec. 1: E½	2198	16
	Sec. 12: NE¼	Private	2
	T. 16 N., R. 20 W.,		
	Sec. 36: SE¼	Indian Allotment	2
		SUBTOTAL	33
Star Lake East (LC)	T. 20 N., R. 5 W.,		
	Sec. 30: SW¼	2198	1
		SUBTOTAL	1
Gallo Wash #2	T. 21 N., R. 8 W.,		
	Sec. 10: NE¼	Public	3 b/
	Sec. 11: NW¼	Public	3 b/
		SUBTOTAL	6
Kimbeto #1	T. 22 N., R. 10 W.,		
	Sec. 2: NW¼	Indian Allotment	2
	Sec. 2: SW¼	Indian Allotment	2
	Sec. 10: NE¼	Indian Allotment	2
	Sec. 11: NW¼	Indian Allotment	2
		SUBTOTAL	8

APPENDIX F-3

(CONTINUED)

TRACT NAME	LEGAL DESCRIPTION	SURFACE OWNERSHIP	NO. OF RESIDENCE(S)
Nageezi	T. 23 N., R. 10 W.,		
	Sec. 8: SW¼	2198	1
	T. 24 N., R. 10 W.,		
	Sec. 28: NE¼	Indian Allotment	2
	Sec. 29: NW¼	Indian Allotment	1
	Sec. 30: NE¼	Public	1
	Sec. 34: SW¼	Indian Allotment	1
		SUBTOTAL	6
		TOTAL RESIDENCES	110

Source: BLM, Albuquerque District, Farmington Resource Area Files

Note: a/ Unoccupied tracts: Bread Springs #2, Hospah #2, La Plata #2, La Plata #4.
b/ Located on lands included in the proposed Navajo Exchange (See DOI, BLM, 1979).

APPENDIX F-4
NAVAJO GRAVESITES IN THE EIS REGION a/

Lease Application No./Tract Name	Legal Description b/	Surface Ownership	No. of Graves
PRLAs			
Surface Mineable			
NM-8128	T. 21 N., R. 8 W.	Indian Allotment/2198	2
NM-3918	T. 22 N., R. 10 W.	Public	4
Underground Mineable			
NM6803	T. 23 N., R. 11 W.	Public/Indian Allotment	4
NM-3836	T. 23 N., R. 11 W.	Public	1
			SUBTOTAL 11
Competitive Tracts (All Surface Mineable)			
Crownpoint Northeast	T. 18 N., R. 12 W.	Indian Allotment	2
Bisti #1	T. 23 N., R. 12 W.	Public	20-30 (Historic Battlefield) c/
Bisti #6/8	T. 23 N., R. 12 W.	Indian Allotment	3
			SUBTOTAL 25-35
			TOTAL REPORTED GRAVES 36-46

Source: BLM, Albuquerque District, Farmington Resource Area Files

Notes: a/ This area probably contains additional gravesites that are not presently known to the BLM.
b/ Section and quarter section designations have been omitted from this table.
c/ This reported battlefield site may contain both Navajo and Ute graves. The number of graves has not been confirmed by the BLM (See USDI, BLM, 1981a for additional information about the site).

APPENDIX F-5
NAVAJO SACRED SITES IN THE EIS REGION a/

Lease Application No./Tract Name	Legal Description b/	Surface Ownership	No. and Site Type
PRLAs (All Surface Mineable)			
NM-8130	T. 20 N., R. 8 W.	2198	1 Offering Point
NM-3919	T. 22 N., R. 10 W.	Public	1 Offering Point
NM-3918	T. 22 N., R. 10 W.	Public	1 Offering Point
NM-3755	T. 22 N., R. 11 W.	Public	1 Offering Point
			SUBTOTAL 4
Competitive Tracts Surface Mineable			
Samson Lake #2	T. 15 N., R. 19 W.	(Boundaries Unknown)	1 Possible Offering Point
Bisti #1	T. 23 N., R. 12 W.	Private	1 Gathering Area
Bisti #4	T. 23 N., R. 12 W.	Public/2198	1 Gathering Area
Underground Mineable			
Star Lake East (LC)	T. 20 N., R. 5 W.	(Boundaries Unkown)	1 Sacred Area (type unknown)
			SUBTOTAL 4
			TOTAL REPORTED SACRED SITES 8

Source: BLM, Albuquerque District, Farmington Resource Area Files

Notes: a/ This area may contain additional sacred sites that are not presently known to the BLM. Ten to fifteen Navajo sacred sites have been estimated to occur on the PRLA Area (DOI, BLM, 1981).
b/ Section and quarter section designation have been omitted from this table.

APPENDIX G
AIR QUALITY

APPENDIX G

AIR QUALITY ANALYSIS ASSUMPTIONS AND METHODOLOGY

Two studies were used in the air quality impact analysis for this EIS. The first study (Pedco 1982) was a conservative screening analysis to determine if a mine or pair of mines had the potential to exceed the applicable ambient air quality standard. Those mines that showed a potential were then analyzed in more depth using a computerized dispersion model CDMQC (ECOS 1982).

Predictions of future effects upon air quality of development projects were based on an atomospheric dispersion modeling analyses of pollutants emitted within and adjacent to the affected areas. Atmospheric dispersion models require two basic types of input data: meteorological data, and pollutant concentrations at specified receptor points around the source. Models are specifically designed to efficiently assess air quality in terms of averaging periods specified in regulatory standards for the affected region, which are appropriate to the environmental conditions. The ECOS study addresses regional effects of hypothesized future mines in the San Juan Basin. The pollutant of concern is TSP; and the modeling region was made sufficiently large to encompass all areas potentially harmed by emissions from proposed coal leasing.

Emissions

Emissions from three types of sources were quantified to determine the air quality of the EIS area: coal mining, both surface and underground; coal transportation (hauling and transferring); and major point sources in the study area.

The major pollutant emitted by the coal mines is particulate emissions of fugitive dust. The mines in the EIS area whose emissions were quantified consist of surface mines and underground mines. The proposed mines consist of a total of 20 surface mine units, five of which would have associated underground mines.

Only fugitive dust emissions were computed for the coal mining activities because particulate matter is the only pollutant which is generated in large enough quantities to have a significant impact on regional air quality.

Proposed and Existing Mine Leases

Emissions of particulate matter from proposed surface and underground mines were calculated directly from geologic and production data for tracts in the San Juan Basin. These data were developed by the Minerals Management Service (MMS) of the Department of the Interior. To complete the emissions calculations, ECOS developed mining scenarios and parameters through discussions with MMS and BLM specialists familiar with the San Juan Basin. A detailed discussion of these assumptions and the resulting emissions data can be found in the Technical Report (ECOS 1982).

The emissions data were then compared with emissions data derived by PEDCO (1982). In the present study, one mine was assumed per tract for calculating potential project emissions. The calculated emissions were somewhat larger than those derived by PEDCO. The present study used the highest emission factors approved by EPA or, where lacking, those in other published studies, while assuming the high level of Best Available Control Technology required by EPA Region VIII.

Emissions calculated for each of the one or more tracts available for development as a single mine under each alternative were then analyzed in order to construct the full production emissions level for that mine and alternative. Most mines in the various project alternatives involved a single tract; and the estimated tract emissions were used for that mine. The mines/alternatives based upon multiple tracts, each with an MMS-defined optimum production rate, were assumed to operate at the rate based upon the largest tract. An operator will develop the most productive tract first to maximize early returns on investment; and this will basically set the subsequent level of coal production when mining adjacent tracts. It was assumed that mines also involving existing federal and state leases will produce at the level set by the largest BLM-proposed tract. This assumption was forced by the lack of data (i.e. proprietary) on coal production from exising leases.

Calculations for one mine (#16) for the various alternatives was more complex. One alternative (No. 3) would involve only existing leases for this mine. To derive the level of production for this mine for this alternative, the average production rate from tracts in each alternative involving BLM tracts was calculated. The smallest average from the Mine 16 BLM alternative was then chosen. In essence, all available data were simply averaged for lack of better information. This procedure was also used to calculate emissions for the No-Project Alternative (No. 1).

Two mines (#18 and #20) involved only existing lease tracts for all alternatives. Thus, all alternatives for these mines would have the same emissions as Alternative 1. An analysis of BLM mine data suggested the plausibility of using BLM-based mine data for other mines situated on the closest tracts (i.e. Mines 17, 19 and 20) (personal communication, Mr. James Edwards, MMS, Farmington District). Thus, Mine 18 for each alternative was assigned an emissions level equal to the average of Alternative 1 emissions for Mines 17 and 19; and those for Mine 20 were set equal to Alternative 1 emissions for Mine 19. Table 3 lists resulting emissions for each mine and alternative. Total emissions for each alternative, irrespective of location of emission source, can be derived by summing the data in each column. These sums are listed as the last row in the table.

Mines in the study area were modeled as point sources. An average emissions height of five meters was assumed for all sources from the mines. This height was derived after considering the size of storage piles and the heights of emissions from trucks and loading devices, crushing and sorting machinery, road repair equipment, etc.

Dispersion Modeling Methodologies

For assessment of annual average impacts, the EPA-guideline Climatological Dispersion Model (CDMQC) was used to predict cumulative concentrations of TSP resulting from each coal leasing alternative, together with emissions from other sources in the San Juan Coal Region.

CDMQC predicts annual average pollutant concentrations based on the steady-state Gaussian dispersion formulation. A technical description of the CDMQC model is provided in the Technical Report (ECOS 1982). The model was designed for assessment of gaseous pollutants; therefore, it was modified to simulate particulate fallout due to gravitational settling. Another modification to the model was the incorporation of an algorithm to calculate annual geometric mean concentrations, since federal and state TSP ambient air quality standards (AAQS) and PSD increments are not specified in terms of arithmetic averages but in geometric means. The modified CDMQC model can also predict concentrations at all grid points of a specified modeling grid and at specific receptor points. The gridded output was processed by a contouring computer program to generate isopleth maps.

In addition to annual average AAQ and PSD increment standards, there are also corresponding 24-hour average standards for TSP. A statistical model developed by Larsen (1971) of the U.S. EPA was used to generate maximum worstcase 24-hour concentrations for receptor points where high annual arithmetic means occur. This statistical procedure is described in the Technical Report.

Modeling Area

Figure 1 shows the spatial extent of the modeling area. The grid origin is located approximately at 652.5 kilometers (km) East, 3874.7 km North, in the Universal Transverse Mercator (UTM) coordinate system for Zone 12. It covers an area of 225 km by 210 km and includes all major emissions sources in the San Juan Coal Region. The modeling grid employs a 5 km resolution in each direction, and contains 45 by 42 (1890) grid cells. For assessment of potential impacts at PSD Class I areas (Mesa Verde National Park and San Pedro Parks Wilderness), and the Chaco Canyon National Monument Class II area, specific receptor points were used in the modeling to predict cumulative increments.

Within the selected modeling grid, emissions from baseline sources and proposed coal mines for each alternative were assigned to proper grid locations. For estimates of worst-case impacts, all emission sources were modeled as point sources.

Meteorological Inputs

The climatological dispersion model CDMQC requires the joint frequency of wind speed, wind direction and atmospheric stability as meteorological inputs. These data are in the form of the Stability Array (STAR) program available from the National Climatic Center. Within the selected modeling area, STAR data are available for the monitoring stations located at Farmington, Gallup and Grants. Since CDMQC can only accommodate a single STAR

deck, the STAR data obtained for these three stations were averaged for use in the modeling. The averaged STAR data were assumed to be representative of climatological dispersion conditions throughout the San Juan Coal Region, without consideration of subregional conditions.

Other meterological inputs required by the CDMQC model include the mean afternoon and nocturnal mixing heights. Values of 2000 meters (m) and 200 m were assigned to these mixing heights.

Background Concentrations

To evaluate the effects of project pollutant emissions, particularly in relation to federal state air quality standards, it is necessary to know the pre-existing, or background, TSP concentrations. A value of 30 ug/m^3 was assumed to represent the annual background. This value corresponds closely to the average annual concentration observed by the state monitoring station at Zuni for the years 1977-1980, and is believed to be the most representative background value available. It was also used in the earlier screening analysis for the proposed coal mines conducted by PEDCO Environmental Inc. (1982).

Modeling Accuracy and Limitations

The modeling studies show the potential worst-case adverse consequences of the project on air quality in terms sufficient to provide an understanding of the types of adverse effects to be expected, their geographical extent, their degrees of intensity, and their relationships to regulatory standards. This information can be used to aid in selection of a preferred alternative, and to anticipate the nature of its impacts. It can also be used as a guide to more detailed future evaluation of the selected alternative and of its specific implementation features.

It must be understood, however, that the modeling studies were limited by various constraints, and the conclusions are consequently subject to limitations which should be borne in mind by the reader.

Only worst-case situations were evaluated, because these are the most important in determining acceptable project limts. However, the worst-case results give no quantitative information on average impacts, or on best case situations, or on frequencies to be expected for worst, average, best, or any other circumstances.

Accuracy of modeling results obtained in this study is affected by a number of potential sources of error, including inaccuracies in modeling inputs and in the dispersion model itself. Particulate emission rates were generated by using mine design parameters estimated by the BLM, which may not be the actual values used by the mine developers. Emissions were also calculated based primarily on empirical emission factors developed for surface coal mines located in other western states (Wyoming, Colorado and Montana); hence, their applicability to coal mines in the San Juan Coal Region is assumed but has not been validated.

Accuracy of modeling results is also affected by the inherent limitations of the CEMQC model. The CDMQC model has not been thoroughly validated for air quality assessment of coal mine development. However, it is generally accepted that its predictions of annual average concentrations are accurate within a factor of two. Its predictions of 24-hour impacts may be less accurate, since they are based on a statistical relationship developed for urban areas. The statistical procedure also assumes that the modeled pollutant has a lognormal distribution for all averaging times. More realistic 24-hour impacts can only be predicted by using a short-term dispersion model and appropriate 24-hour meteorological scenarios. The CDMQC model was originally developed in an urban area and was not modified for use in a rural scenario.

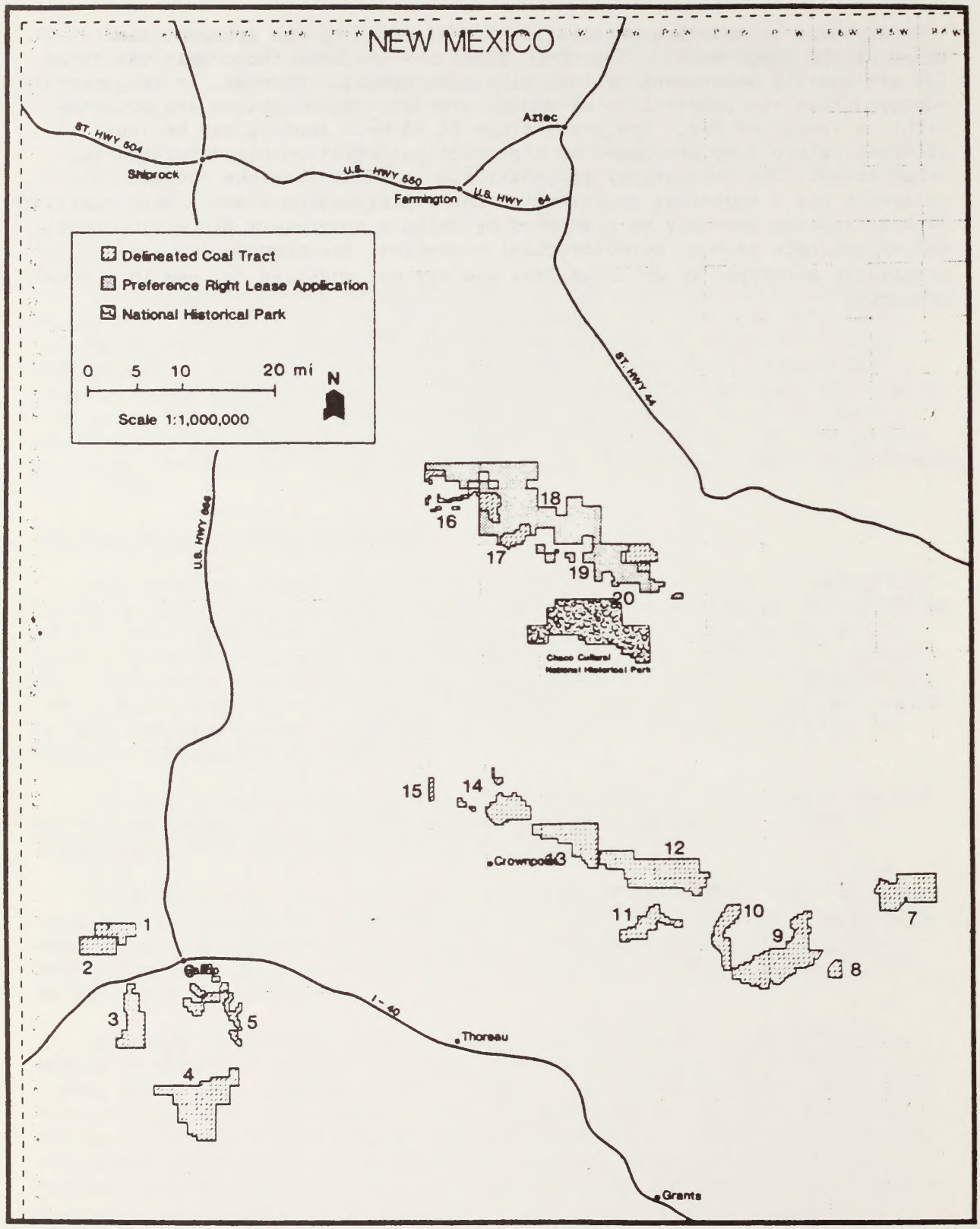


FIGURE 1 SAN JUAN BASIN COAL REGION STUDY AREA

TABLE 3

TSP EMISSIONS BY ALTERNATIVE*

Mine Number	Alternative Number 1	2	3	4	5
1	0.	141.00	0.00	141.00	141.00
2	0.	0.00	0.00	118.22	118.22
3	0.	0.00	0.00	0.00	3174.57
4	0.	0.00	0.00	0.00	372.15
5	0.	0.00	0.00	215.09	215.09
6	0.	0.00	0.00	615.99	615.99
7	0.	0.00	0.00	0.00	2753.17
8	0.	0.00	673.28	673.28	673.28
9	0.	0.00	3682.30	3682.30	3682.30
10	0.	0.00	3838.31	3838.31	3838.31
11	0.	0.00	1979.73	1979.73	1979.73
12	0.	2198.28	2198.28	2198.28	2198.28
13	0.	0.00	0.00	0.00	368.95
14	0.	0.00	0.00	0.00	4735.83
15	0.	0.00	0.00	0.00	305.70
16	234.	279.35	234.	1763.62	1763.62
17	1120.	1120.07	1120.	1120.07	1120.07
18	940.	940.	940.	940.	940.
19	489.	759.06	759.06	759.06	759.06
20	759.	759.	759.	759.	759.
	3542	6196	16183	18803	30514

* Emissions in tons per year

APPENDIX H
SURFACE OWNER CONSULTATION

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IN REPLY REFER TO
3120

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

P.O. BOX 568
FARMINGTON, NEW MEXICO 87401

CERTIFIED-RECEIPT REQUESTED

Dear Surface Owner:

The Bureau of Land Management has completed its land use planning for the area and is initiating actions necessary to consider issuing new competitive coal leases. These actions include tract delineation in conjunction with the U. S. Geological Survey, Site Specific Analysis and the San Juan River Regional Coal Environmental Impact Statement.

Our review of Federal and State records show that you own the surface over the following lands in which the United States has retained ownership of the mineral estate including the coal in and under the land:

You may meet qualifications under section 714 of the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1304) to be classed as a "surface owner." We would be happy to meet with you to discuss these qualifications. If you qualify, this classification gives you certain types of protection. Under current law, the Department cannot issue a new competitive lease and authorize a company to surface mine federal coal under your land without your permission. The Department may be proposing to lease the coal under your land in the near future.

The purpose of this letter is to consult with you and to give you a chance to tell us whether you would favor or oppose leasing of coal under your land. To assist you in understanding this process, I would like to tell you what your views will do and what they will not do.

(1) If you are in favor of leasing, you are not bound by that decision and you may still, at a later date, withhold your permission to leasing and prevent the Department from issuing a lease for the coal in these lands. However, if you have already given your written consent for surface coal mining on your land you may have lost the right to withhold your consent at a later date.

(2) If you express a preference against the Department's issuing a lease for coal under your land, the Department may or may not eliminate that land from further consideration for development. If at a later date you change your mind and favor leasing, the Department may reconsider whether the coal under your land should be leased.

(3) Even if you are in favor of leasing, the Department is under no obligation to offer the coal under your land for lease. The Department may decide that the lands should not be offered because of environmental problems. It may decide that other lands contain better coal and should be developed before the coal under your land. It may also decide that there is no need to lease that coal because other lands are already available for mining. The general question whether new coal leasing is needed on a national basis is now being studied by the Department.

I, or a member of my staff, would be happy to talk with you if you have any questions about this letter. Please feel free to call us. Your response to this letter is an important part of the leasing process and I want you to understand it completely.

Sincerely yours,

Richard T. Watts
Acting Area Manager

Enclosure

IN REPLY REFER TO
3120

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

P.O. BOX 568
FARMINGTON, NEW MEXICO 87401

CERTIFIED-RECEIPT REQUESTED

Dear Surface Owner:

The Bureau of Land Management has completed its land use planning for the area and is initiating actions necessary to consider issuing new competitive coal leases. These actions include tract delineation in conjunction with the U. S. Geological Survey, Site Specific Analysis and the San Juan River Regional Coal Environmental Impact Statement.

Our review of Federal and State records show that you own the surface over the following lands in which the United States has retained ownership of the mineral estate including the coal in and under the land:

You may meet qualifications under section 714 of the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1304) to be classed as a "surface owner." We would be happy to meet with you to discuss these qualifications. If you qualify, this classification gives you certain types of protection. Under current law, the Department cannot issue a new competitive lease and authorize a company to surface mine federal coal under your land without your permission. The Department may be proposing to lease the coal under your land in the near future.

The purpose of this letter is to consult with you and to give you a chance to tell us whether you would favor or oppose leasing of coal under your land. To assist you in understanding this process, I would like to tell you what your views will do and what they will not do.

(1) If you are in favor of leasing, you are not bound by that decision and you may still, at a later date, withhold your permission to leasing and prevent the Department from issuing a lease for the coal in these lands. However, if you have already given your written consent for surface coal mining on your land you may have lost the right to withhold your consent at a later date.

(2) If you express a preference against the Department's issuing a lease for coal under your land, the Department may or may not eliminate that land from further consideration for development. If at a later date you change your mind and favor leasing, the Department may reconsider whether the coal under your land should be leased.

(3) Even if you are in favor of leasing, the Department is under no obligation to offer the coal under your land for lease. The Department may decide that the lands should not be offered because of environmental problems. It may decide that other lands contain better coal and should be developed before the coal under your land. It may also decide that there is no need to lease that question whether new coal leasing is needed on a national basis is now being studied by the Department.

It would be most helpful if you could return your response to this request on the attached form as soon as possible or within the next 30 days.

Our Navajo BLM personnel, Danny Charlie and Pauline McCauley are working with this consultation and you can contact them at 325-3581, Farmington Resource Area office.

Mrs. McCauley will be at the following location to explain this letter and answer any questions in reference to this letter.

Crownpoint BIA Conference Room, August 6, 1982, 8:00 a.m. to 3:00 p.m.

I, or a member of my staff, would be happy to talk with you if you have any questions about this letter. Please feel free to call us. Your response to this letter is an important part of the leasing process and I want you to understand it completely. We have enclosed a brochure on the rights of surface owners over Federal coal for your information.

Sincerely yours,

Richard T. Watts
Acting Area Manager

Enclosure

GLOSSARY

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

ACRE-FOOT. The volume of water that would cover one acre to a depth of one foot. It is equivalent to 43,560 cubic feet.

ACTIVITY OCCASIONS. One person participating in one recreation activity during 12 or more hours of one day.

ALKALI SOIL. A soil with a high degree of alkalinity (pht of 8.5 or higher) or with a high exchangeable sodium content 215 percent or more of the exchange capacity), or both. A soil that contains sufficient alkali sodium to interfer with the growth of most plants.

ALLUVIUM. Clay, silt, sand, gravel, or other materials transported by flowing water and deposited in comparatively recent geologic time sorted or semisorted sediments in riverbeds, estuaries, and flood plains, on lakes, shores, and in fans at the base of mountain slopes.

AUM. Animal Unit Month - The amount of forage necessary for the sustenance of one cow or its equivalent for a period of one month.

AQUIFER. A geologic unit which contains water and which is permeable enough to transmit that water to wells and springs. A bedrock aquifer consists of consolidated rock; an alluvial aquifer consists of unconsolidated valley-fill deposits

AREA OF CRITICAL ENVIRONMENTAL CONCERN (ACEC). An area within the public lands where special management attention is required (when such areas are developed or used, or where no development is required) to protect the area and prevent irreparable damage to important wilderness, cultural, recreational, paleontological, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards.

ARTESIAN CONDITIONS. Ground water which is under sufficient pressure (always greater than atmospheric) to rise above the top of the aquifer when tapped by a well. This ground water does not necessarily rise to or above the land surface. A flowing artesian well flows at the land surface. Artesian is synonymons with confined.

ASSOCIATED (SOIL). A group of soils geographically associated in a characteristics repeating pattern and defined and delineated as a single map unit.

AVAILABLE WATER. The portion of water in a soil that can be readily absorbed by plant roots.

AVAILABLE WATER CAPACITY. The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

BADLANDS. Steep or very steep, commonly nonstony barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geological material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

BEDROCK. The solid rock that under lies the soil and other unconsolidated material or that is exposed at the surface.

BIOTA. All the microorganism, fauna and flora associated within a given environment.

BLOWN-OUT LAND. Areas from which all or almost all of the soil and soil material has been removed by wind erosion. A miscellaneous land type.

BRITISH THERMAL UNIT (Btu). The quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at or near 39.2 degrees Fahrenheit.

BROWN SOILS. A great soil group of the temperate to coal arid regions, composed of soils with a brown surface and a light-colored transitional subsurface horizon. They develop under short grasses.

BULK DENSITY (SOIL). The mass of dry soil per unit bulk volume including the air space.

CHACOAN OUTLIERS. More than 70 prehistoric pueblo communities connected by a system of roads and visual communication into a sophisticated socioeconomic complex centering on the Chaco Culture National Historical Park (ca. A.D. 828-1178).

CLINKER. Remnants of burned coal.

COARSE-TEXTURED SOIL. Sand or loamy sand.

COLLUVIUM. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the bases of steep slopes.

COMPONENT. The assemblage of artifacts left by each of two or more cultural groups using a single site at different periods.

CONDENSATE. A liquid obtained by condensation of a gas or vapor.

CRETACEOUS. Period of geologic time known as the "Age of the Dinosaurs", 130-63 m.y.

DECLARED UNDERGROUND WATER BASIN. An area in New Mexico declared by the State Engineer when he feels that management controls of ground water are necessary.

EOLIAN SOIL MATERIAL. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

EPHEMERAL STREAM. A stream that flows only in response to a storm.

EROSION. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

EXCHANGE CAPACITY. The capacity of a soil to exchange ions as measured by the quantity of exchangeable ions in that soil.

FACIES. The aspect belonging to a geologic unit of sedimentation, including mineral composition, type of bedding, fossil content, etc.; also a stratigraphic body as distinguished from other bodies of differing appearance or composition.

FERTILITY (SOIL). The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable

FINE TEXTURED. Sandy clay, silky clay, and clay.

FLOODPLAIN. A strip of relatively flat alluvium that borders a stream and is subject to repeated flooding.

FLUVIAL. Of or pertaining to a river or rivers. Produced by the action of a stream or river.

GROUND-WATER DISCHARGE. The process of depletion of ground water from an aquifer.

GROUND-WATER FLOW. The movement of ground water within an aquifer.

GROUND-WATER RECHARGE. The process of replenishing ground water in an aquifer.

HOMESTEAD. Usually 640 acres of public land obtained by an individual filing for title in accordance with homestead laws administered by the BLM. An individual must have resided on the land and constructed a certain number of improvements to obtain title. Title to Indians qualified for homesteads was usually issued as a Trust Patent. A Trust Patent is issued in the name of an individual Indian, but the land is held in trust by the United State and administered by the BIA.

HORIZON (SOILS). A layer of soil, approximately paralled to the surface, having distinct characteristics produced by soil-forming processes.

INDIAN ALLOTMENT. The act of February 8, 1887 made provision for Indians not living upon a reservation or for whose tribe a reservation had not been provided. Indians settled upon public land not otherwise taken were entitled upon application to have land allotted to them. Allotment titles were issued under Trust Patent.

INFILTRATION. The downward entry of water into the soil.

INFILTRATION RATE. A soil characteristic determining or describing the maximum rate at which water can enter the soil under specified conditions, including the presence of an excess of water.

IMMATURE SOIL. A soil with indistinct or only slightly developed horizons because of the relatively short time it has been subjected to the various soil-forming processes.

INVENTORY. A descriptive listing and documentation, including photographs and maps, of cultural resources; included are the processes of locating, identifying, and recording sites, structures, buildings, objects, and districts through library area archival research, information from persons knowledgeable about cultural resources and varying levels of intensity of on-the-ground field surveys.

LENTICULAR. Having the shape of a double-convex lens.

MONOCLINE. A geologic structure (series of strata) dipping only in one direction.

NATIONAL REGISTER OF HISTORIC PLACES. The official list, establish by the Historic Preservation Act of 1966, of the nation's cultural resources worthy of preservation. The Register lists archaeological, historic, and architectural properties (i.e., districts, sites, buildings, structures, and objects) nominated for their local, State or national significance by State and/or Federal agencies and approved by the National Register staff.

NATIONAL REGISTER QUALITY. Those cultural resource properties which meet the National Register criteria and have been determined eligible for nomination to the National Register of Historic Places by virture of their local, State, or national significance.

NAVAJO. The largest Indian tribe in the United States. Entering the southwest ca. A.D. 1500 as nomadic hunter/gatherers, by A.D. 1696 the Navajo had turned to the herding/gardening economy practice by many tribal members today.

OUTCROP. That part of a geologic formation or structure that appears at the surface of the earth.

OVERBURDEN. Unconsolidated rock material overlying a mineral deposit and which must be removed prior to mining.

PARENT MATERIAL. The unconsolidated organic and mineral material in which soil forms.

PERMEABILITY (SOIL). The ease with which gases, liquids, or plant roots penetrate or pass through a bulk mass of soil or a layer of soil.

P.L.O. 2198 LANDS. Public domain lands originally granted to the railroad. In 1921 these lands were reconveyed back to the federal government and other lands selected by the railroad in an attempt to consolidate railroad grant and Indian lands into solid blocks of holdings. Under Public Land Order 2198 these reconveyed lands were set aside for Indian use and placed under the administration of the BIA. The BIA issues 90-day revocable homesite leases on 2198 lands.

POROSITY. The amount of open pore space in a consolidated or unconsolidated geologic formation.

PREFERENCE RIGHT LEASE APPLICATION (PRLA). A formal request made to the BLM for a non-competitive coal lease. PRLAs were issued by the Secretary of the Interior in the San Juan Basin between 1971 and 1973 to the holders of prospecting permits. These individuals or companies were required to demonstrate that, during the period of the permit, they had discovered commercial quantities of coal.

PRODUCTIVITY (SOIL). The capacity of a soil for producing a specified plant or sequence of plants under a specified system of management.

PROFILE (SOIL). A vertical section of the soil extending through all its horizon and into the parent material.

PROVENIENCE. Source of origin of fossil material in relation to the depositional environment.

PUBLIC LANDS. Lands owned by the United States and managed by the Department of Interior, Bureau of Land Management.

RANK. A coal classification based on the degree of change in molecular structure of the coal, caused by great heat or pressure (metamorphism). There are four major ranks. The lowest rank, lignite, is the least metamorphosed while the highest rank, anthracite, is the most highly metamorphosed. Subbituminous is the rank just above lignite, wiht bituminous ranked above subbituminous. Ranking is determined by the number of Btu's in one pound of the coal being classified. The letter A, B, or C after a rank classification is a subdivision within that rank.

REGRESSIVE. Pertaining to a retreat or contraction of the sea from land areas.

RESIDUUM (RESIDUAL SOIL MATERIAL). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

RIVER BASIN. The area drained by a river.

ROUGH BROKEN LAND. Land with very steep topography and numerous intermittent drainage channels but usually covered with vegetation.

RUNOFF. The precipitation discharged in stream channels from a drainage area.

SALVAGE. The recovery of material and data from an affected cultural resource, prior to its alteration or destruction, through, recordation documentation, partial or total excavation, and collection for analysis and interpretation.

SITE. A physical location utilized by human beings for a specific purpose. An archeological site is identified as having been used by humans in the past through the artifacts that remain.

SLICK SPOTS. Small areas that are slick when wet, due to a high content of alkali or of exchangeable sodium.

SLOPE. The inclination of the land surface from the horizontal.

SOIL. A natural, three dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the intergrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

SOIL (organic matter). The organic fraction of the soil that includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synethesized by the soil population.

SPECIFIC CAPACITY. The rate of discharge of water from a pumping well divided by the water-level decline within the well.

SPOILS. Waste rock material generated by surface mining.

STRUCTURAL BASIN. A roughly bowl-shaped depression which is filled with sedimentary rocks. A structural basin owes its form to tectonic activity.

STRUCTURE (SOIL). The arrangement of primary soil particles into compound particles or aggregates.

SUBBITUMINOUS COAL. Coal having between 8,300 and 13,000 BTU per pound.

SUBSOIL. Technically, the B horizon; roughly the part of the solum below plow depth.

SUBSTRATUM. The part of the soil below the solum.

SUBSURFACE LAYER. Technically, A_2 horizon.

SURFACE SOIL. The uppermost part of the soil, ordinarily moved in tillage, or its equivalent in unculturated soils and ranging in depth from 3 to 4 inches to 8 to 10.

TEXTURE (SOIL). The relative proportions of sand, silt, and clay particles in a mass of soil.

TRANSGRESSIVE. Pertaining to a spread or extension of the sea over land areas.

TRANSMISSION LOSS. The process of seepage of surface-water flow into stream bed deposits.

TRANSMISSIVITY. The rate at which ground water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

UPLAND (GEOLOGY). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

VISITOR-DAY. Twelve visitor-hours, which may be aggregated continuously, intermittently, or simultaneously by one or more persons. Visitor-days may occur either as recreation visitor-days or as non-recreation visitor-days.

VOLATILE. Changing readily to vapor.

VRM (VISUAL RESOURCE MANAGEMENT). The system by which the Forest Service and BLM classify and manage the visual resource of public lands under their respective jurisdictions. Based on their scenic qualities, sensitivities, and the distances from which they are viewed, the lands are classified into management units.

VRM CLASS I. A BLM visual resource management classification that allows for natural ecological change only.

VRM CLASS II. A BLM visual resource management classification that allows for management activities that are not visually evident.

VRM CLASS III. A BLM visual resource management classification that allows for management activities to be visually evident but subordinate to the landscape character.

VRM CLASS IV. A BLM visual resource management classification that allows for management activities to subordinate the landscape character.

VRM CLASS V. A BLM visual resource management classification that identifies areas where manmade disturbance is excessive and rehabilitation is necessary.

WATER TABLE CONDITIONS. Ground water which is under atmospheric pressure. This ground water does not rise above the top of the aquifer when tapped by a well. Water table is synonymous with unconfined.

WEATHERING. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents.

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VISUAL A

SAN JUAN RIVER COAL REGION ENVIRONMENTAL IMPACT STATEMENT

LEGEND

LAND STATUS

- PRIVATE
- INDIAN WITHDRAWAL
- MILITARY RESERVATION
- NATIONAL PARK SERVICE
- BANKHEAD-JONES LAND USE LAND (LU LAND)
- STATE
- INDIAN
- FOREST SERVICE
- PUBLIC

MINERAL STATUS WITHIN COAL TRACTS

- COAL ONLY
- OIL & GAS
- ALL MINERALS
- OIL, GAS & COAL
- NONE
- COAL LEASE TRACTS

N

0 5 10 MILES
SCALE

HUERFANO TRADING POST
BLANCO TRADING POST
OTIS
NAGEEZI
LYBROOK
COUNSELOR
KIMBETO
TSAYA
CHACO CULTURE NATIONAL HISTORICAL PARK
GALLO WASH #2
GALLO WASH #1
STAR LAKE WEST #2
STAR LAKE EAST #1
STAR LAKE EAST (LC)
JOHNSON TRADING POST
STAR LAKE
TORREON
CUBA
CROWNPOINT EAST
CROWNPOINT NORTHEAST
CROWNPOINT
HOSPAH #2
HOSPAH #1
CHICO WASH SOUTH
DIVIDE
LEE RANCH WEST
LEE RANCH MIDDLE
LEE RANCH EAST
GAMERCO #2 (UG) (LC) (ENTIRE TRACT)
GAMERCO #1 (LC)
SAMSON LAKE #1 (ENTIRE TRACT)
GAMERCO #1 (HC)
GALLUP
SAMSON LAKE #2
CATALPA CANYON
HODBACK
SUNDANCE
BREAD SPRINGS #1
BREAD SPRINGS #2
TAH-HA-TAH WELL
TWIN BUTTES
PINEHAVEN
THOREAU
BLUEWATER LAKE
COTTONWOOD CREEK
FARMINGTON
LA PLATA #1
LA PLATA #2
LA PLATA #3
LA PLATA #4
LA PLATA
UTE MTN INDIAN RESERVATION
JICARILLA APACHE INDIAN RESERVATION
NAVAJO INDIAN RESERVATION
FORT WINGATE
CIBOLA NATIONAL FOREST
ZUNI INDIAN RESERVATION
BARTOLOME FERNANDEZ GRANT
CEBOLLETA GRANT
NUESTRA SENORA DE LA LUZ DE LAS LAGUNITAS GRANT
IGNACIO CHAVEZ GRANT
FELIPE TAFOYA GRANT
OJO DEL ESPIRITO SANTO GRANT
SANTA FE NATIONAL FOREST
CAÑON DE SAN DIEGO GRANT
JEMEZ INDIAN RESERVATION
ZIA INDIAN RESERVATION
LAGUNA INDIAN RESERVATION
TOWN OF ALAMEDA GRANT
HUNTER WASH
CHACO WASH
ESCAVADA WASH
CAÑON LARGO
PUERCO RIVER
RIO PUERCO
RIO GUADALUPE
SAN JOSE RIVER

MAP AREA
Farmington
Taos
Santa Fe
Gallup
Grants
Albuquerque
Socorro
Roswell
Carlsbad
Las Cruces
NEW MEXICO

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VISUAL B

SAN JUAN RIVER COAL REGION ENVIRONMENTAL IMPACT STATEMENT

LEGEND

VISUAL RESOURCE MANAGEMENT CLASS AREAS

- CLASS II
- CLASS III
- CLASS IV

VRM MANAGEMENT CLASS BOUNDARY

TENTATIVE VRM MANAGEMENT CLASS BOUNDARY

COAL DEVELOPMENTS

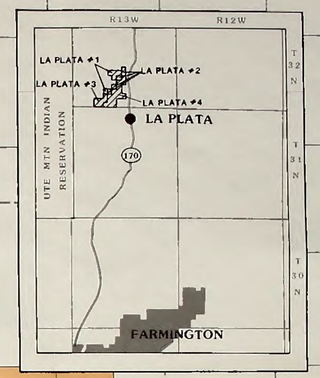
- PREFERENCE RIGHT LEASE APPLICATIONS
- COMPETITIVE COAL LEASE TRACTS
- EXISTING COAL LEASES

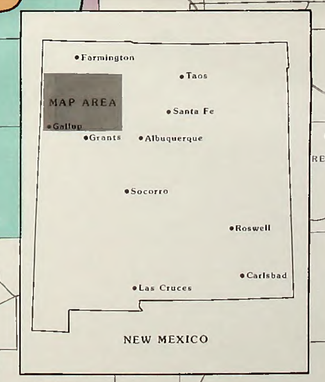
N

0 5 10 MILES

SCALE

HUERFANO TRADING POST
BLANCO TRADING POST
OTIS
NAGEEZI
LYBROOK
COUNSELOR
JICARILLA APACHE INDIAN RESERVATION
KIMBETO
TSAYA
BISTI #2
BISTI #4(a&b)
BISTI #8&8
NM-0188812
NM-0188813
NM-0188815
NM-3834
NM-3838
NM-1818
NM-3835
NM-7235
NM-8603
NM-3753
NM-8602
NM-3754
NM-3836
NM-10831
NM-3837
NM-8604
NM-3755
KIMBETO #1
KIMBETO #2
NM-3818
NM-8745
NM-8784
NM-8128
CHACO CULTURE NATIONAL HISTORICAL PARK
GALLO WASH #2
NM-11670
GALLO WASH #1
NM-8130
NM-8715
STAR LAKE WEST #2
STAR LAKE EAST #1
STAR LAKE EAST (LC)
NM-2457
NM-8717
JOHNSON TRADING POST
STAR LAKE
CUBA
SANTA FE NATIONAL FOREST
CAÑON DE SAN DIEGO GRANT
JEMEZ INDIAN RESERVATION
ZIA INDIAN RESERVATION
TORREON
NAVAJO INDIAN RESERVATION
CROWNPOINT EAST
CROWNPOINT NORTHEAST
CROWNPOINT
HOSPAH #2
HOSPAH #1
DIVIDE
CHICO WASH SOUTH
OJO DEL ESPIRITO SANTO GRANT
IGNACIO CHAVEZ GRANT
FELIPE TAFOYA GRANT
LEE RANCH WEST
LEE RANCH MIDDLE
LEE RANCH EAST
BARTOLOME FERNANDEZ GRANT
CIBOLA NATIONAL FOREST
NUESTRA SEÑORA DE LA LUZ DE LAS LAGUNITAS GRANT
CEBOLLETA GRANT
LAGUNA INDIAN RESERVATION
TOWN OF ALAMEDA GRANT
GAMERCO #2 (UG) (LC) (ENTIRE TRACT)
GAMERCO #1 (LC)
SAMSON LAKE #1 (ENTIRE TRACT)
GAMERCO #1 (HC)
SAMSON LAKE #2
GALLUP
CATALPA CANYON
HOGBACK
FORT WINGATE
SUNDANCE
BREAD SPRINGS #1
BREAD SPRINGS #2
TAH-HA-BAH WELL
TWIN BUTTES
THOREAU
PINEHAVEN
ZUNI INDIAN RESERVATION





R20W R19W R18W R17W R16W R15W R14W R13W R12W R11W R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E

T25N T24N T23N T22N T21N T20N T19N T18N T17N T16N T15N T14N T13N T12N

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VISUAL C

SAN JUAN RIVER COAL REGION ENVIRONMENTAL IMPACT STATEMENT

LEGEND

COAL DEVELOPMENTS

- NM-8803 — PREFERENCE RIGHT LEASE APPLICATION
- COMPETITIVE COAL LEASE TRACTS
- EXISTING LEASES
- PROPOSED RAILROAD
- EXISTING RAILROAD
- UTILITY RIGHT-OF-WAY CORRIDOR

N

0 5 10 MILES
SCALE

HUERFANO TRADING POST
BLANCO TRADING POST
OTIS
NAGEEZI
LYBROOK
COUNSELOR
KIMBETO
TSAYA
CHACO CULTURE NATIONAL HISTORICAL PARK
CUBA
STAR LAKE
TORREON
CROWNPOINT
CROWNPOINT NORTHEAST
CROWNPOINT EAST
HOSPAH #1
HOSPAH #2
DIVIDE
GALLUP
THOREAU
PINEHAVEN
BISTI #1
BISTI #2
BISTI #4(a&b)
BISTI #8&8
GAMERCO #1 (LC)
GAMERCO #2 (UG) (LC) (ENTIRE TRACT)
SAMSON LAKE #1 (ENTIRE TRACT)
SAMSON LAKE #2
KIMBETO #1
KIMBETO #2
GALLO WASH #1
GALLO WASH #2
STAR LAKE EAST #1
STAR LAKE WEST #2
STAR LAKE (EAST (LC)
JOHNSON TRADING POST
CHICO WASH SOUTH
LEE RANCH WEST
LEE RANCH MIDDLE
LEE RANCH EAST
TWIN BUTTES
CATALPA CANYON
HOGBACK
SUNDANCE
BREAD SPRINGS #1
BREAD SPRINGS #2
TAH-HA-BAH WELL
LA PLATA #1
LA PLATA #2
LA PLATA #3
LA PLATA #4
LA PLATA
FARMINGTON
NAVAJO INDIAN RESERVATION
JICARILLA APACHE INDIAN RESERVATION
UTE MTN INDIAN RESERVATION
FORT WINGATE
CIBOLA NATIONAL FOREST
SANTA FE NATIONAL FOREST
JEMEZ INDIAN RESERVATION
ZIA INDIAN RESERVATION
ZUNI INDIAN RESERVATION
LAGUNA INDIAN RESERVATION
OJO DEL ESPIRITO SANTO GRANT
IGNACIO CHAVEZ GRANT
BARTOLOME FERNANDEZ GRANT
CEBOLLETA GRANT
NUESTRA SENORA DE LA LUZ DE LAS LAGUNITAS GRANT
SAN DIEGO GRANT
TOWN OF ALAMEDA GRANT
CAÑON DE SAN DIEGO
PUERCO RIVER
CHACO WASH
BLANCO WASH
HUNTER WASH
KIMBETO WASH
CHICO WASH
COTTONWOOD CREEK
BLUEWATER LAKE
RIO PUERCO
RIO GRANDE
RIO JEMEZ
RIO SAN JOSE
LA PLATA RIVER
ANIMAS RIVER

MAP AREA
Farmington
Taos
Santa Fe
Gallup
Grants
Albuquerque
Socorro
Roswell
Carlsbad
Las Cruces
NEW MEXICO

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VISUAL D

SAN JUAN RIVER COAL REGION ENVIRONMENTAL IMPACT STATEMENT

LEGEND

NAVAJO OCCUPANCIES

- CHAPTER HOUSE
- CHAPTER BOUNDARY
- COAL TRACT
- DISTRICT BOUNDARY
- PREFERENCE RIGHT LEASE APPLICATION
- EXISTING LEASE

NAVAJO OCCUPANCIES

PRLA's	HOUSE-HOLDS	RESI-DENCES
NM-585	5	7
NM-8715	1	2
NM-8717	3	3
NM-8130	8	12
NM-8128	9	14
NM-3918	8	11
NM-6801	5	6

COMPETITIVE LEASE TRACTS	RESI-DENCES
Tah-Ha-Bah Well	2
Gamerco#2	35
Star Lake #1	33
Star Lake East (LC)	1
Gallo Wash #2	6
Kimbeto #1	8
Nageezi	6

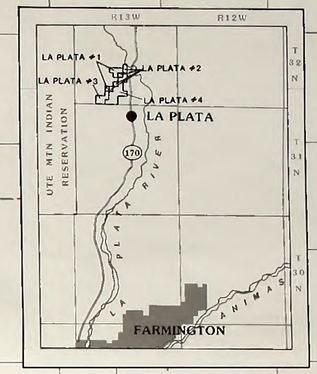
COMPETITIVE LEASE TRACTS	RESI-DENCES
Pinehaven	106
Sundance	7
Bread Springs #1	17
Twin Buttes	93
Divide	3
Hogback	167
Samson Lake #2	15
Gamerco #1 (LC)	2
Gamerco #1 (HC)	2
Chico Wash South	17
Crownpoint East	25
Crownpoint Northeast	37
Johnson Trading Post	8
Star Lake East #1	11
Bisti #6	2

0 5 10 MILES
SCALE

HUERFANO TRADING POST
BLANCO TRADING POST
OTIS
NAGEEZI
LYBROOK
COUNSELOR
JICARILLA APACHE INDIAN RESERVATION
KIMBETO
TSAYA
WHITE ROCK
LAKE VALLEY
CHACO CULTURE NATIONAL HISTORICAL PARK
CRYSTAL
COUNSELOR
GALLO WASH #2
NM-11670
GALLO WASH #1
NM-8128
NM-8130
NM-8715
OJO ENCINO
STAR LAKE WEST #2
STAR LAKE EAST #1
STAR LAKE EAST (LC)
JOHNSON TRADING POST
NM-2457
NM-585
NM-8717
PUEBLO PINTADO
STAR LAKE
CUBA
SANTA FE NATIONAL FOREST
BECENTI
MEXICAN SPRINGS
NAVAJO INDIAN RESERVATION
STANDING ROCK
COYOTE CANYON
WHITEHORSE LAKE
TORREON
CROWNPOINT EAST
CROWNPOINT NORTHEAST
TWIN LAKES
NAHODISHGISH
CROWNPOINT
HOSPAH #2
JEMEZ INDIAN RESERVATION
CAÑON DE SAN DIEGO GRANT
ZIA INDIAN RESERVATION
OJO DEL ESPIRITO SANTO GRANT
ROCK SPRINGS
LITTLE WATER
HOSPAH #1
CHICO WASH SOUTH
PINEDALE
MARIANO LAKE
CHURCH ROCK
GAMERCO #2 (UG) (LC) (ENTIRE TRACT)
GAMERCO #1 (LC)
SAMSON LAKE #1 (ENTIRE TRACT)
GAMERCO #1 (HC)
GALLUP
SAMSON LAKE #2
TSAYATOH
DIVIDE
IGNACIO CHAVEZ GRANT
SMITH LAKE
CASAMERO LAKE
DEFENSE TAFOYA GRANT
LEE RANCH WEST
LEE RANCH MIDDLE
LEE RANCH EAST
HOGBACK
CATALPA CANYON
FORT WINGATE
SUNDANCE
TWIN BUTTES
RED ROCK
TAH-HA-BAH WELL
BREAD SPRINGS #1
BREAD SPRINGS #2
MANUELITO
THOREAU
HAYSTACK
BARTOLOME FERNANDEZ GRANT
CIBOLA NATIONAL FOREST
NUESTRA SENORA DE LA LUZ DE LAS LAGUNITAS GRANT
BREAD SPRINGS
PINEHAVEN
CIBOLA NATIONAL FOREST
BACA
CEBOLLETA GRANT
CHI-CHIL-TAH
ZUNI INDIAN RESERVATION
LAGUNA INDIAN RESERVATION
TOWN OF ALAMEDA GRANT

BISTI #2
NM-6801
NM-3834
NM-11916
NM-3838
NM-0186812
NM-0186813
NM-0186815
NM-3835
NAGEEZI
BISTI #1
NM-3753
NM-7235
NM-8802
NM-8803
NM-3752
NM-3836
NM-3754
NM-10931
NM-3837
BISTI #6&8
BISTI #5(a&b)
NM-8804
NM-3919
KIMBETO #1
NM-3755
NM-3916
NM-3919
KIMBETO #2
NM-3918
NM-8745
NM-9764
NM-8129

R20W R19W R18W R17W R16W R15W R14W R13W R12W R11W R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E
T25N T24N T23N T22N T21N T20N T19N T18N T17N T16N T15N T14N T13N T12N



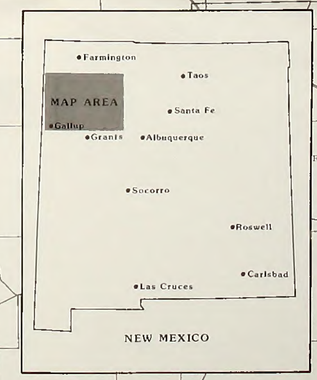


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PLATE 1. Projected drawdowns (in feet)

DRAFT **the No Action Alternative.**

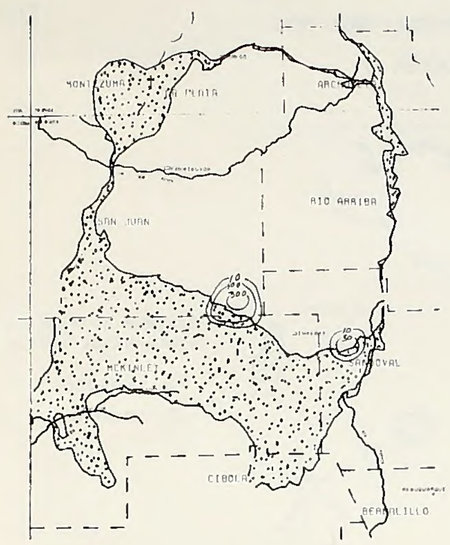
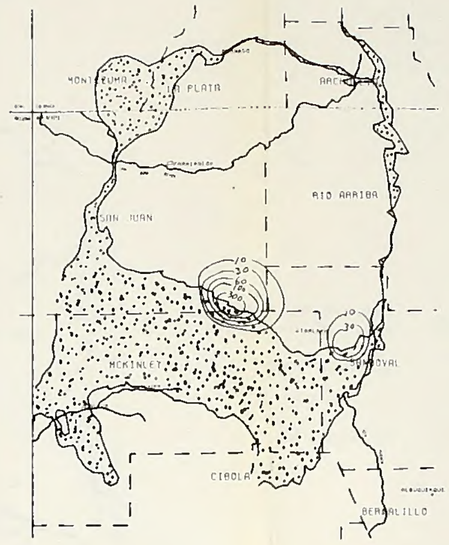
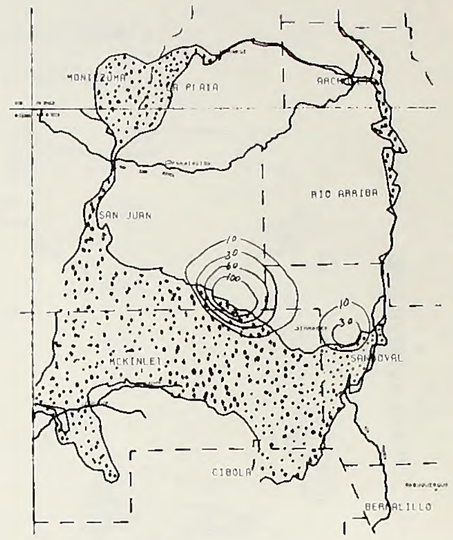
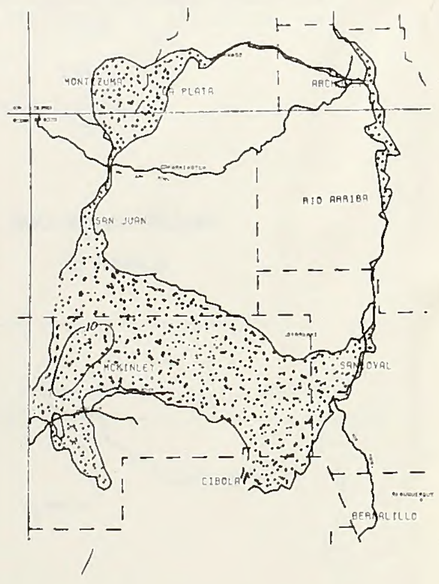
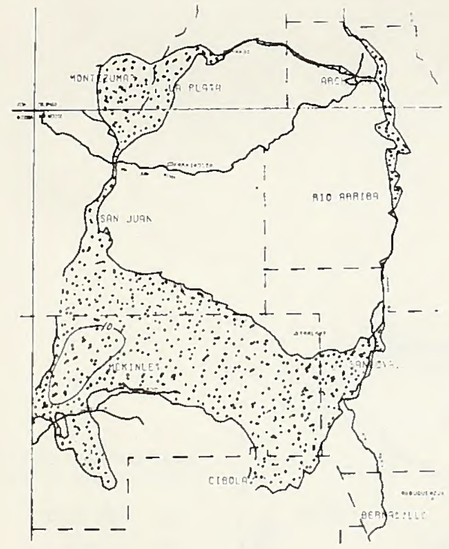
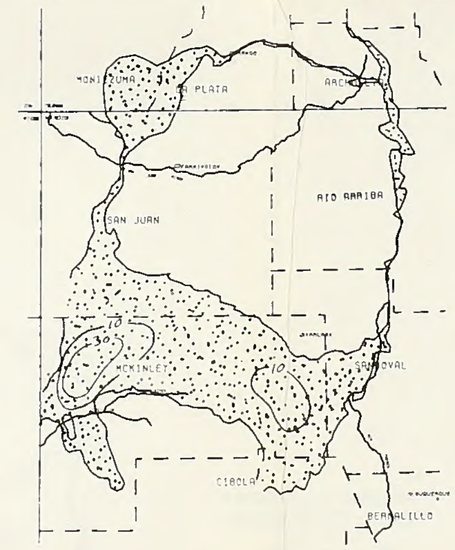
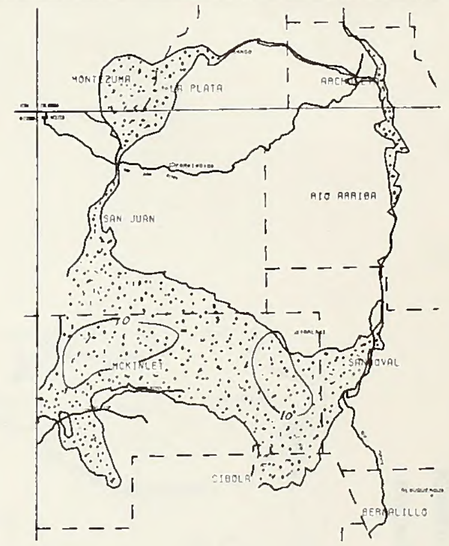
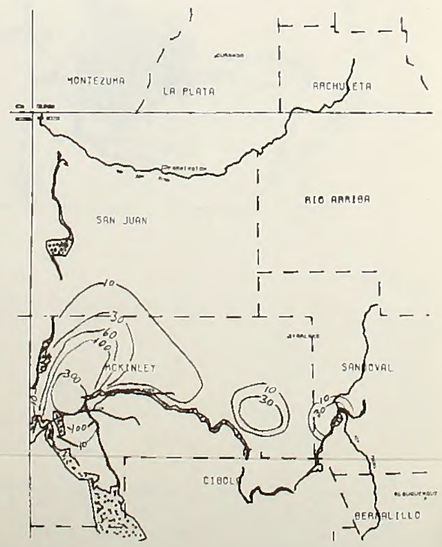
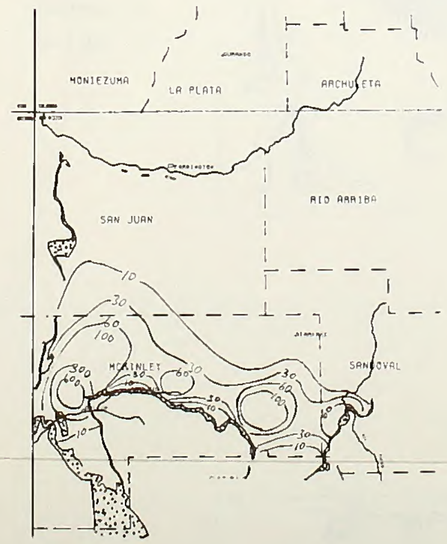
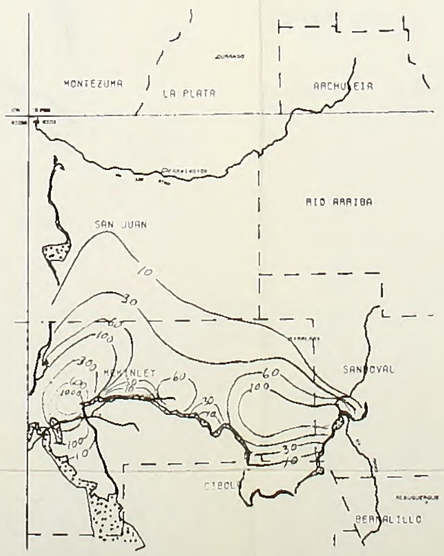
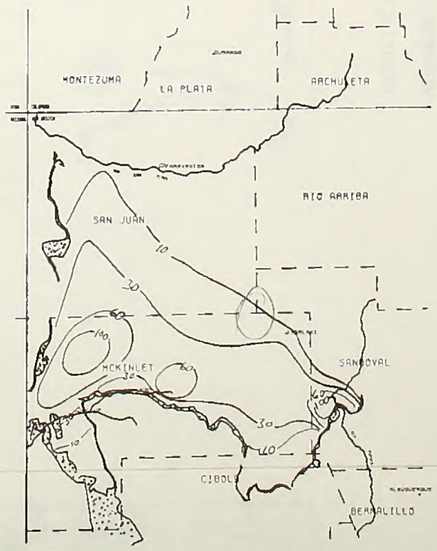
EXPLANATION

10 — Decline in water level, in feet. Contour interval is variable.

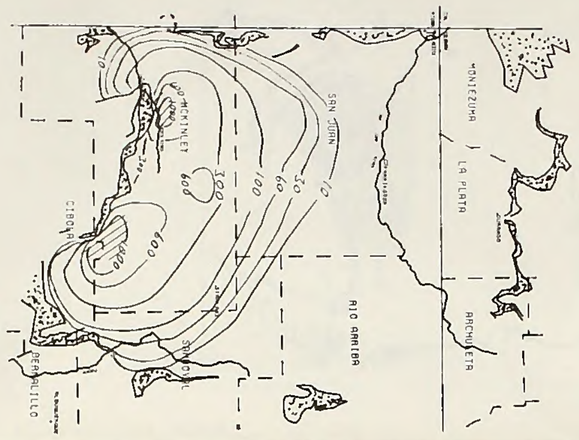
Outcrop area. Outcrops shown are for Jurassic rocks (Layers 1 and 3), Gallup Sandstone (Layer 5), and Mesaverde Group above the Gallup Sandstone (Layers 6 and 7).

Area where drawdowns may cause aquifer conditions to change from confined to unconfined (effectively increasing storage by a factor of 1000) and limit further drawdowns.

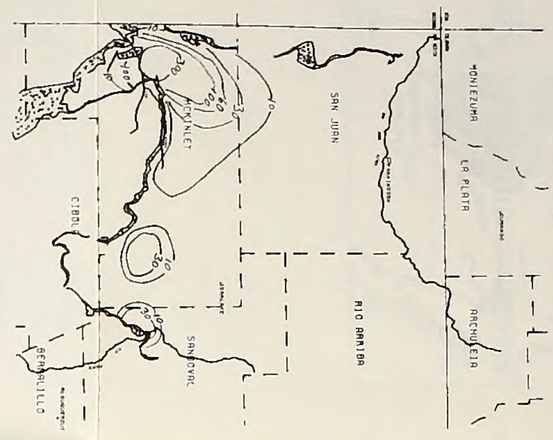
SCALE
0 6 12 18 MILES

	1987	2000	2020	2040
UPPER MESAVERDE GROUP (LAYER 7)				
CREVASSE CANYON FORMATION (LAYER 6)				
GALLUP SANDSTONE (LAYER 5)				

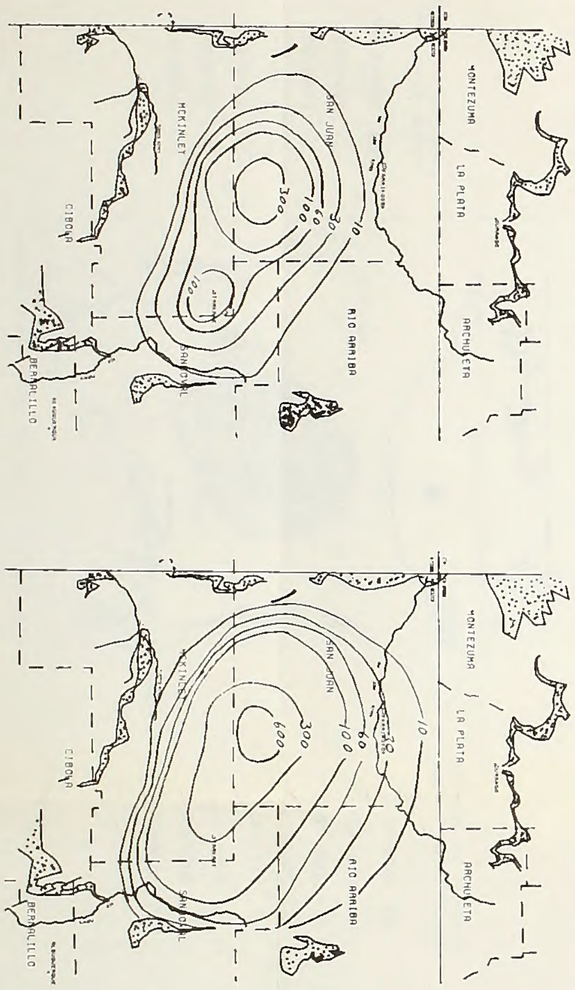
WESTWATER CANYON MEMBER
OF MORRISON FORMATION
(LAYER 3)

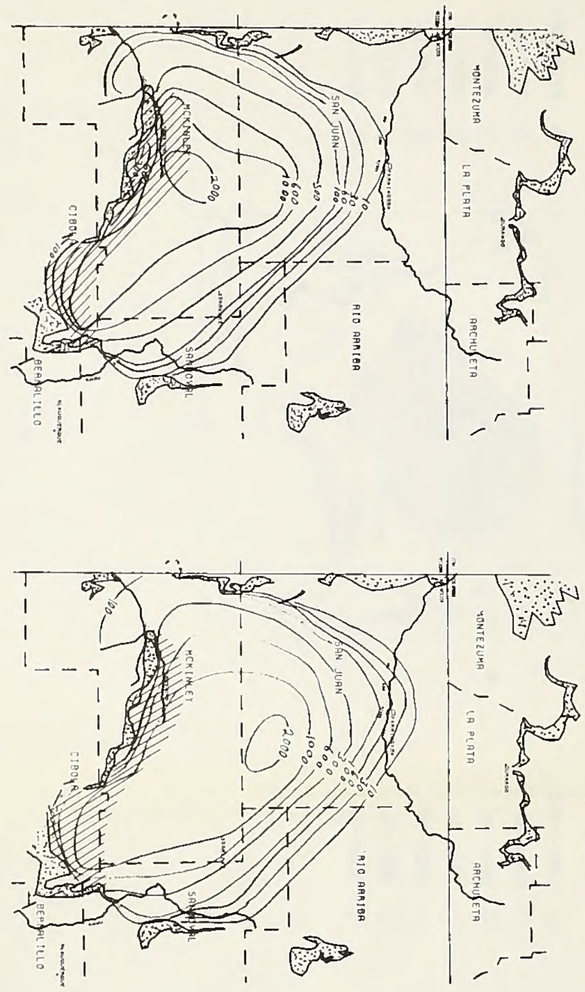


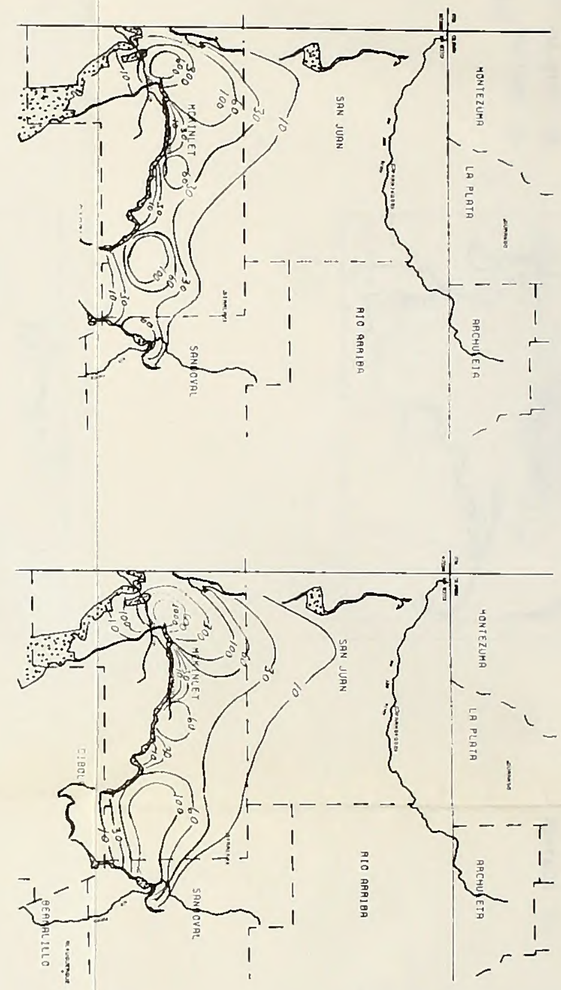
GALLUP SANDSTONE
(LAYER 5)

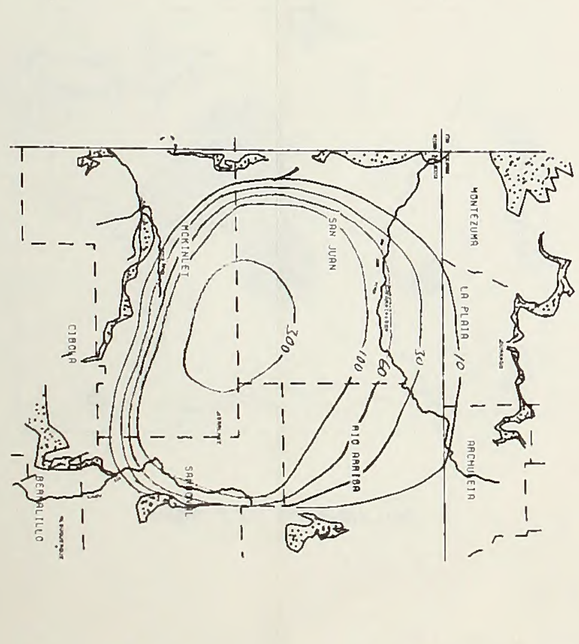


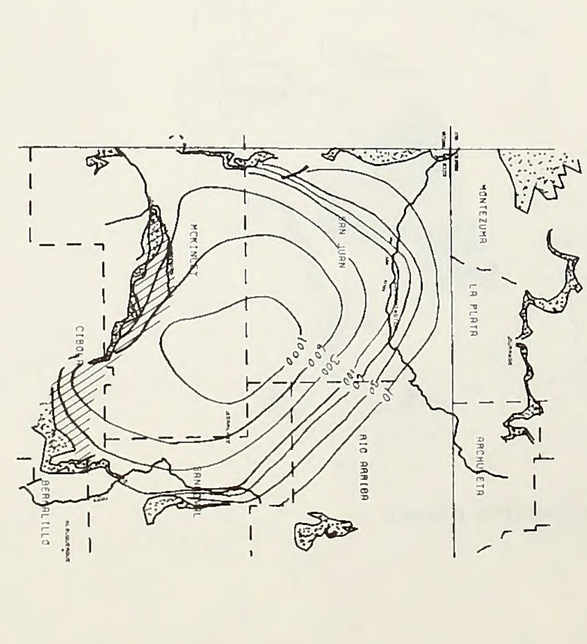
ENTRADA SANDSTONE
(LAYER 1)











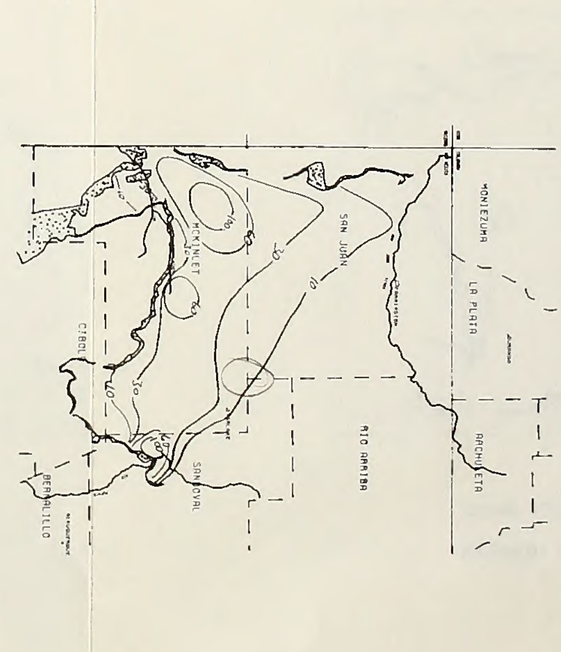


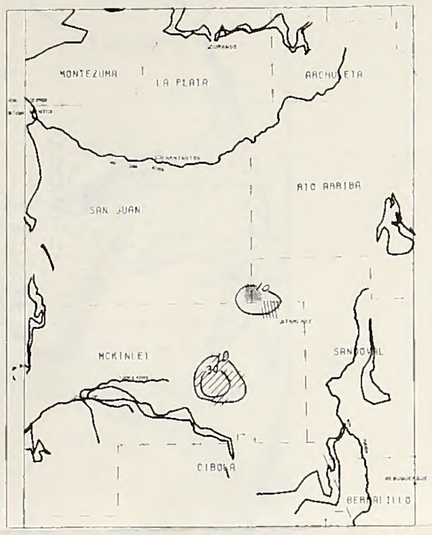
PLATE 2. Maximum differences between projected drawdowns (in feet) of the No Action Alternative and each of the other Alternatives, and the Time Periods during which the maximum differences would occur.

DRAFT

BYPASS ALTERNATIVE

ENTRADA SANDSTONE

(LAYER 1)



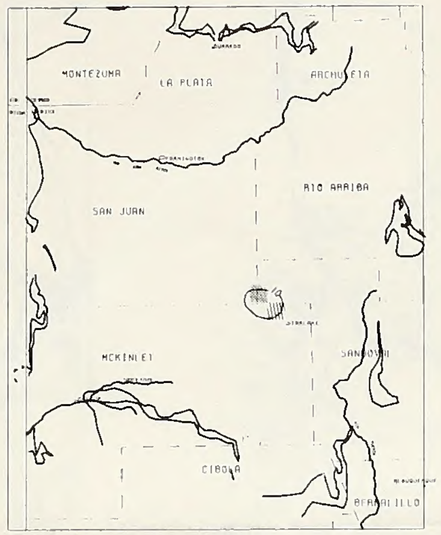
MAXIMUM DIFFERENCE WOULD OCCUR DURING

- 1996-2000
- 2011-15
- 2026-30

WESTWATER CANYON MEMBER

OF MORRISON FORMATION

(LAYER 3)



MAXIMUM DIFFERENCE WOULD OCCUR DURING

- 1996-2000
- 2011-15

EXPLANATION

10 — Line of equal maximum difference in water-level decline, in feet, between No Action Alternative and other Alternative. Contour interval is variable.

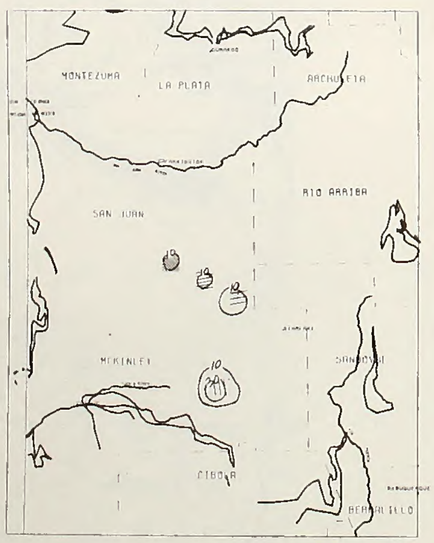
Example:

At Point A on the map for the Gallup Sandstone (Layer 5)-Target Alternative, the maximum difference in drawdown between the No Action Alternative and the Target Alternative would be between 10 and 30 feet and would occur during 2026-30.

SCALE

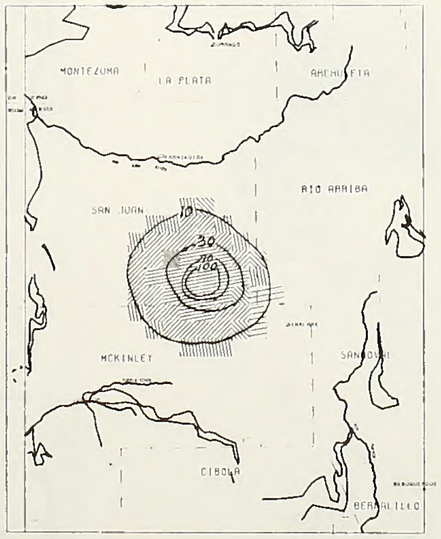
0 6 12 18 MILES

MINIMUM SURFACE OWNER CONFLICTS ALTERNATIVE



MAXIMUM DIFFERENCE WOULD OCCUR DURING

- 1996-2000
- 2001-05
- 2021-25
- 2031-35

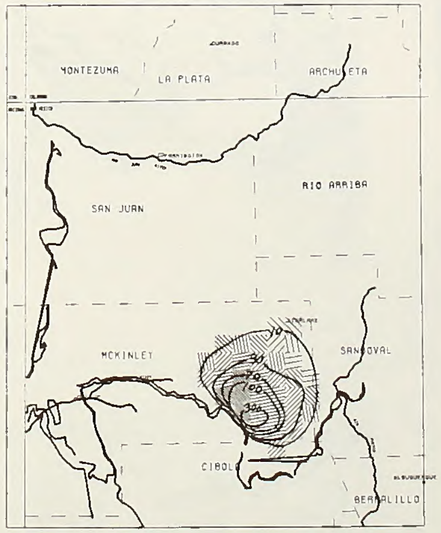


MAXIMUM DIFFERENCE WOULD OCCUR DURING

- 1996-2000
- 2001-05
- 2006-10
- 2011-15
- 2016-20
- 2021-25

GALLUP SANDSTONE

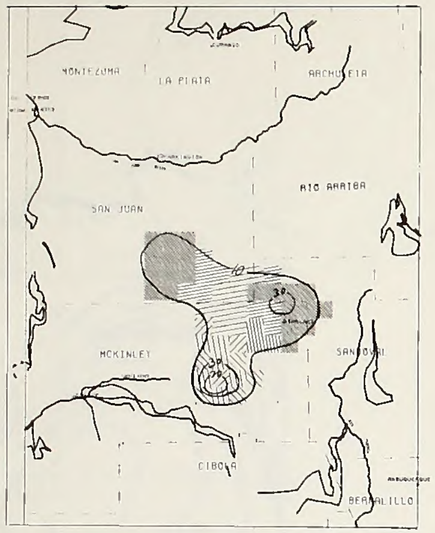
(LAYER 5)



MAXIMUM DIFFERENCE WOULD OCCUR DURING

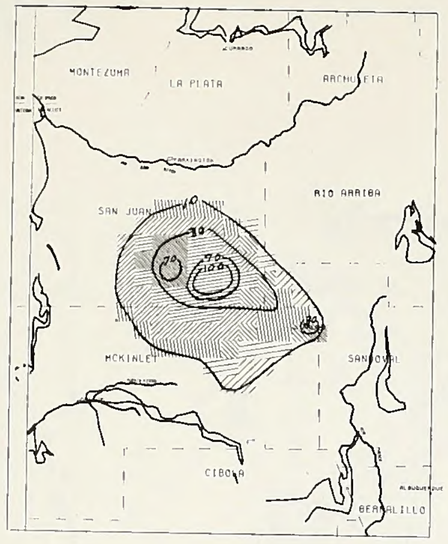
- 1996-2000
- 2001-05
- 2006-10
- 2011-15
- 2016-20
- 2021-25
- 2026-30
- 2031-35
- 2036-40

TARGET ALTERNATIVE



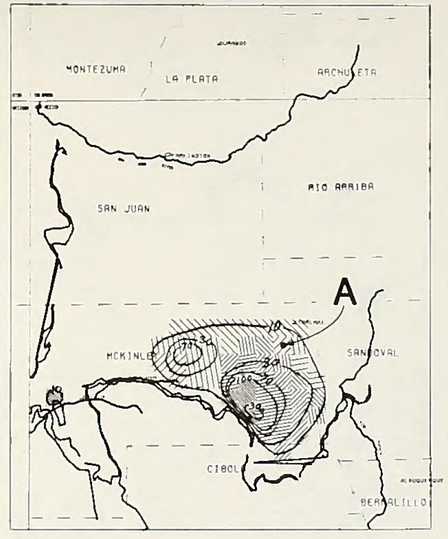
MAXIMUM DIFFERENCE WOULD OCCUR DURING

- 1996-2000
- 2001-05
- 2011-15
- 2021-25
- 2026 30
- 2031-35
- 2036-40



MAXIMUM DIFFERENCE WOULD OCCUR DURING

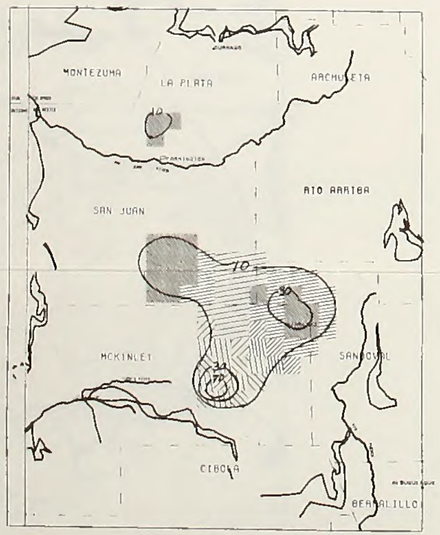
- 1996-2000
- 2001-05
- 2006-10
- 2011-15
- 2016-20
- 2021-25
- 2026-30



MAXIMUM DIFFERENCE WOULD OCCUR DURING

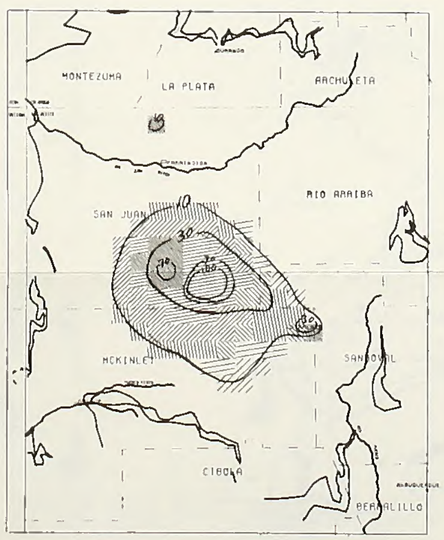
- 1996-2000
- 2001-05
- 2006-10
- 2011-15
- 2016-20
- 2021-26
- 2026-30
- 2031-35
- 2036-40

HIGH-LEVEL ALTERNATIVE



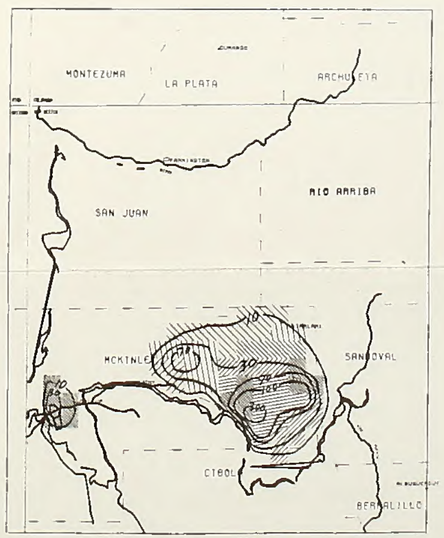
MAXIMUM DIFFERENCE WOULD OCCUR DURING

- 1996-2000
- 2001-05
- 2006-10
- 2011-15
- 2016-20
- 2021-25
- 2026-30
- 2031-35
- 2036-40



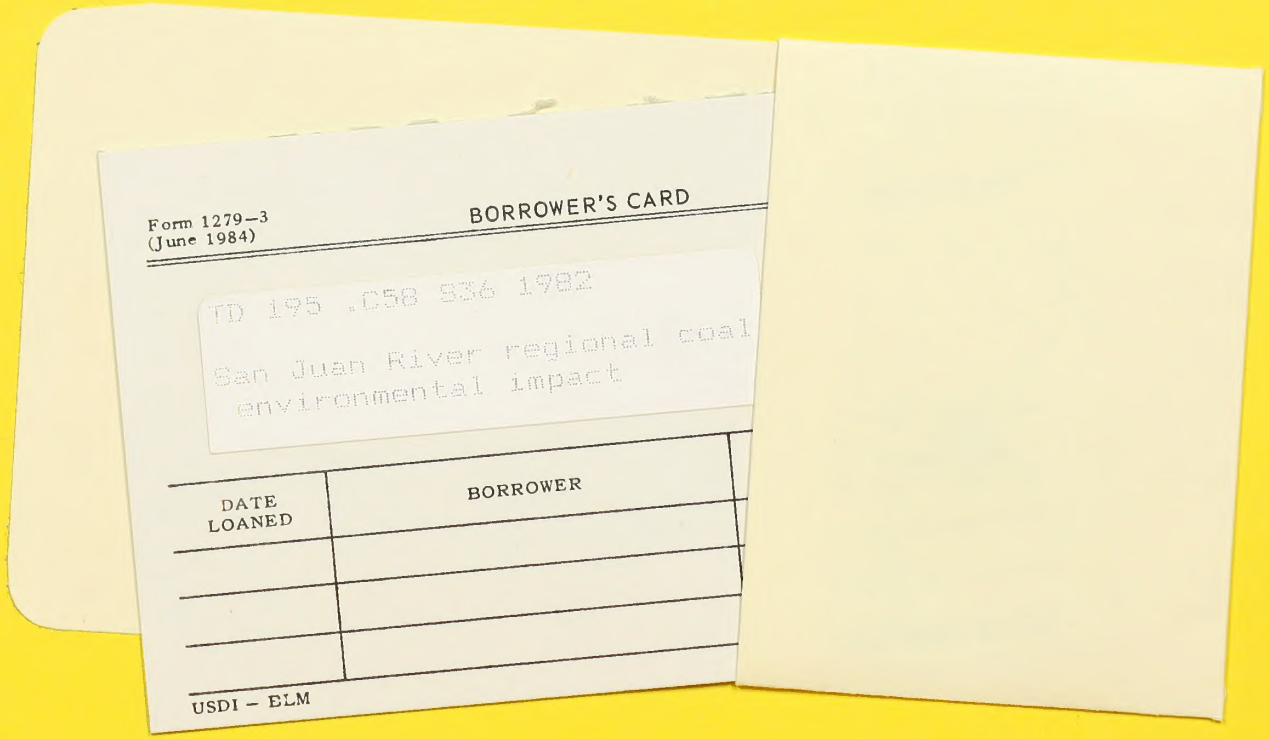
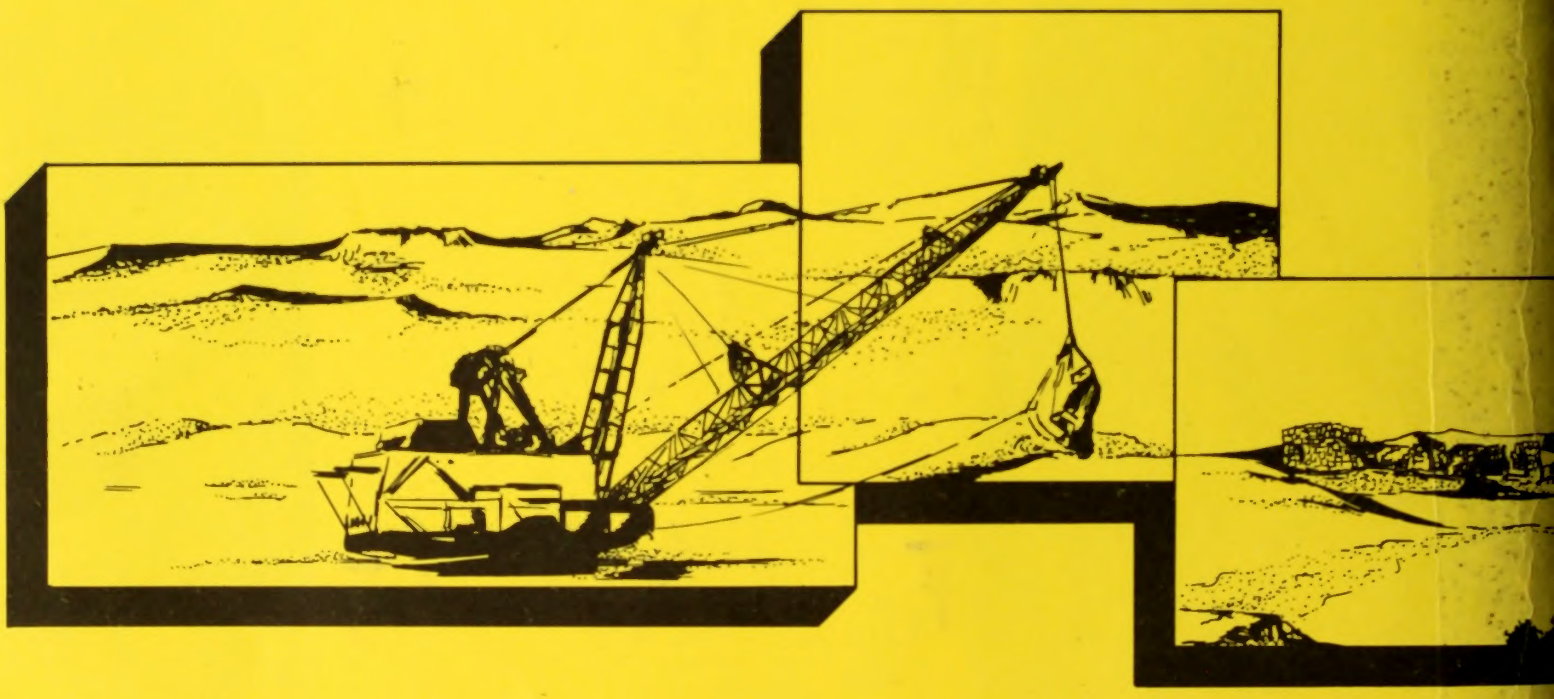
MAXIMUM DIFFERENCE WOULD OCCUR DURING

- 1996-2000
- 2001-05
- 2006-10
- 2011-15
- 2016-20
- 2021-25
- 2026-30



MAXIMUM DIFFERENCE WOULD OCCUR DURING

- 1996-2000
- 2001-06
- 2006-10
- 2016-20
- 2026-30
- 2031-36
- 2036-40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